ELECTRICAL TIMES

THURSDAY
28 JUNE
1951
NINEPENCE

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

J. & P. ALUMINIUM SHEATHED CABLES

It is surprising what a difference the reduction in weight makes both when transporting and when installing aluminium sheathed cables. But then, 20% to 70% is a considerable reduction. If it is used unarmoured, as it frequently can be, the saving in weight is even greater—as is the financial saving.

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The mark that means that "little more" in quality

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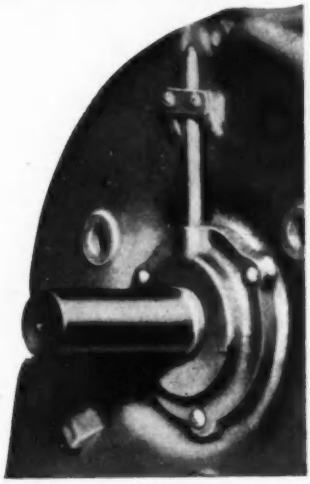

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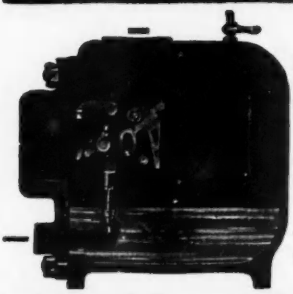

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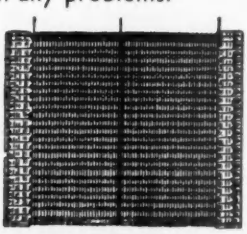

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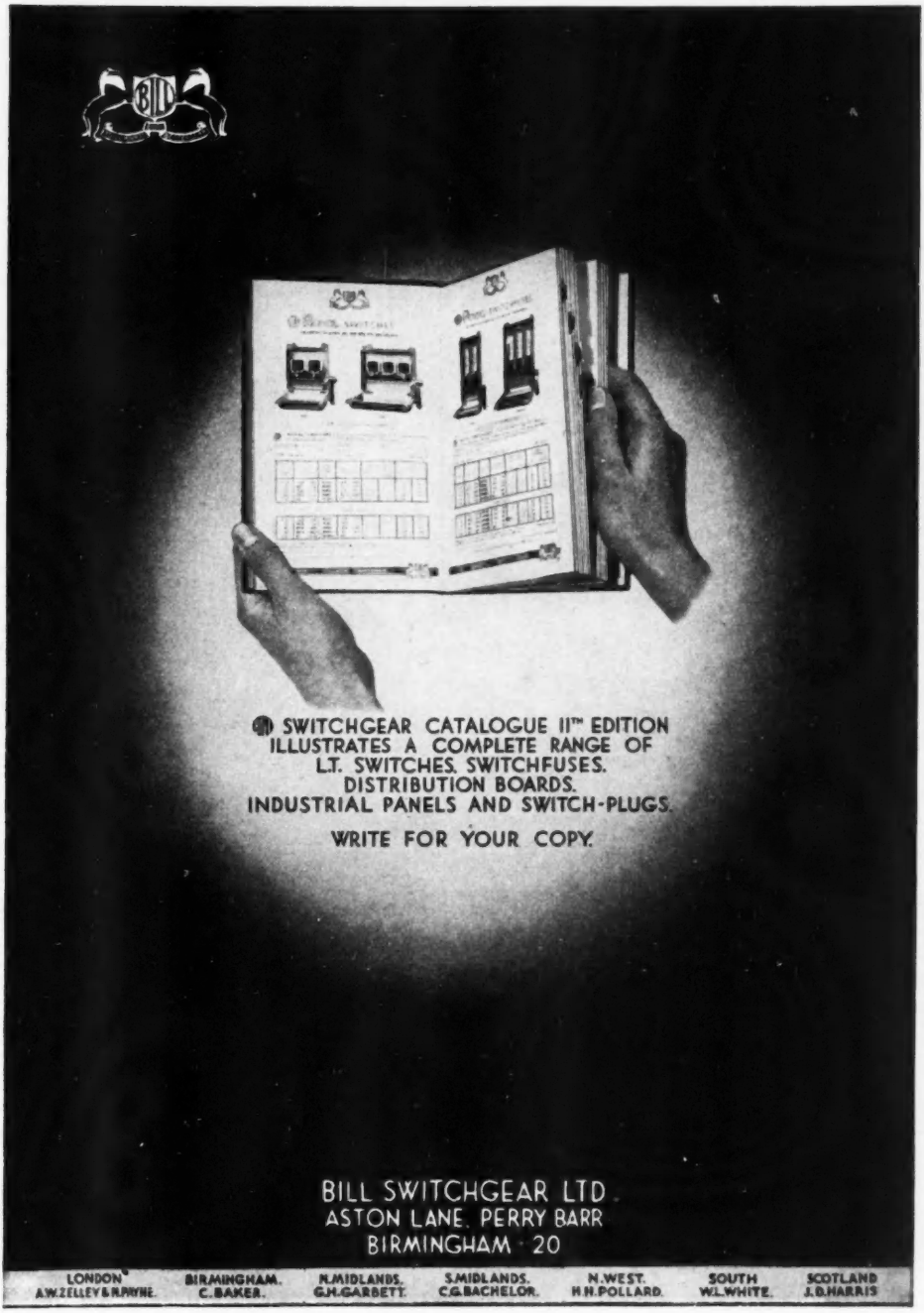
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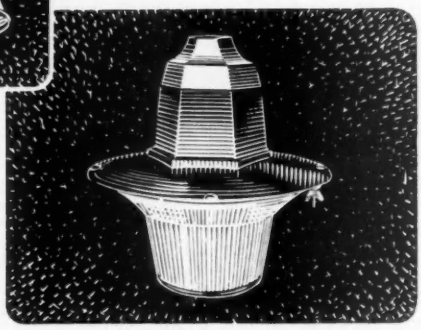

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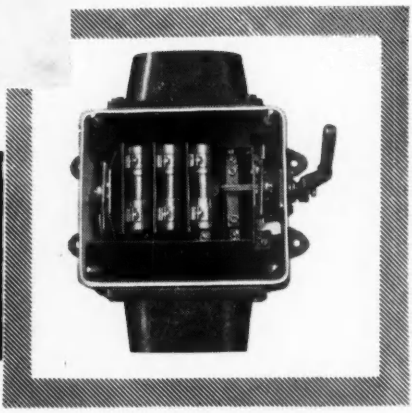

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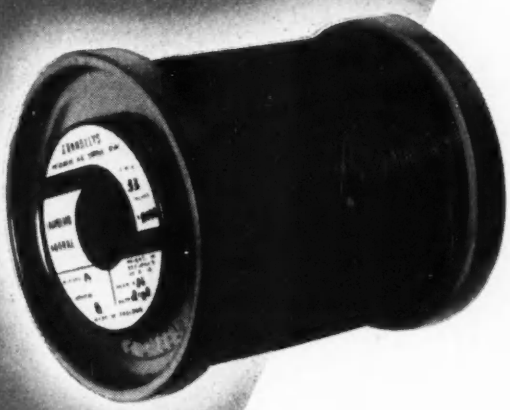

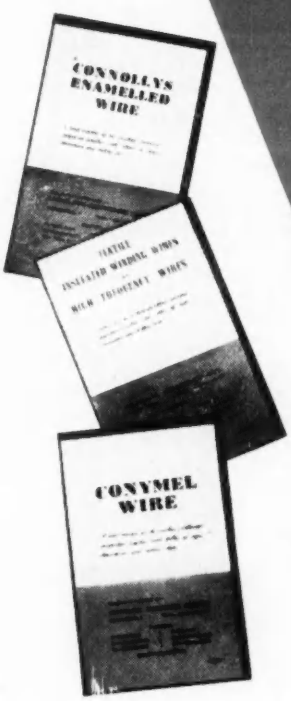

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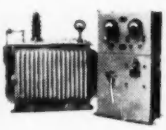

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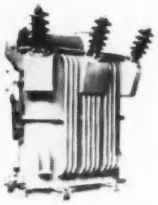

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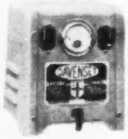

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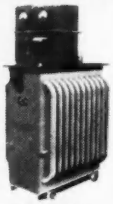

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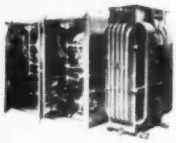

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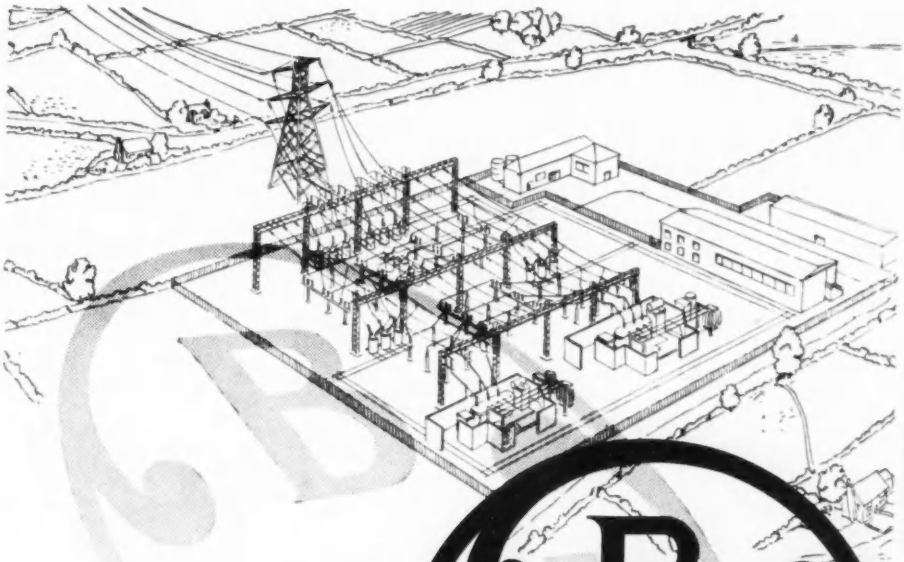

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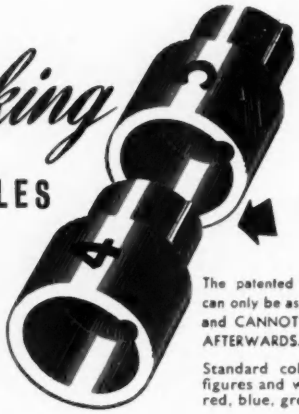
The Critchley Interlocking Ferrule is a simple, speedy and economical solution to the problem of identifying cable ends in electrical equipment which demands a wide range of markings.



Keyed for permanent alignment

The patented key ensures that the ferrules can only be assembled with the figures in line, and CANNOT COME OUT OF ALIGNMENT AFTERWARDS.

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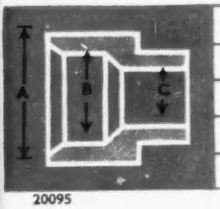

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SIZE	Dim A	Dim B	Dim C
1	275"	3/16"	3/32"
2	354"	1/4"	3/64"
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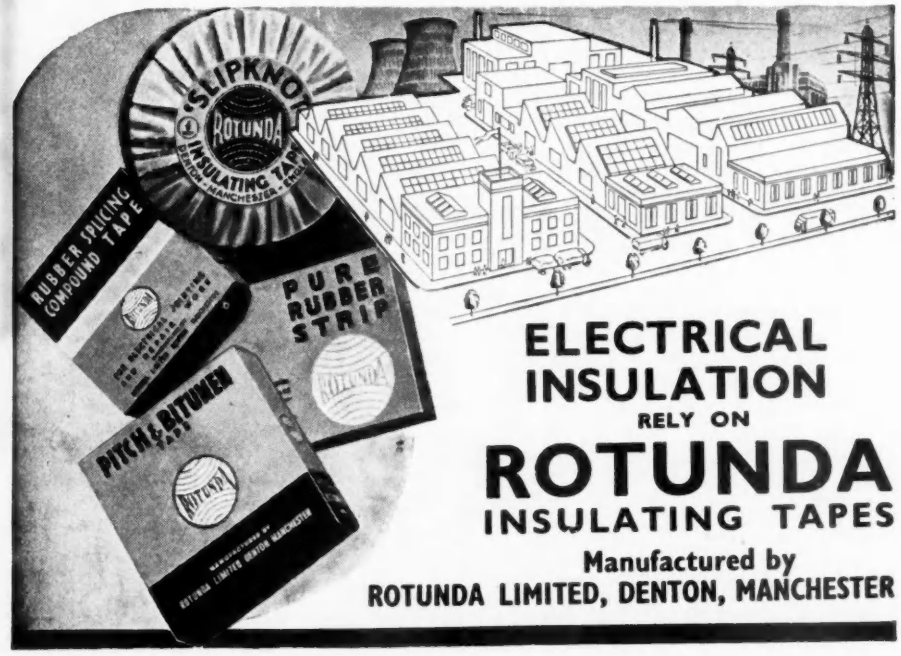

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INSULATING TAPES

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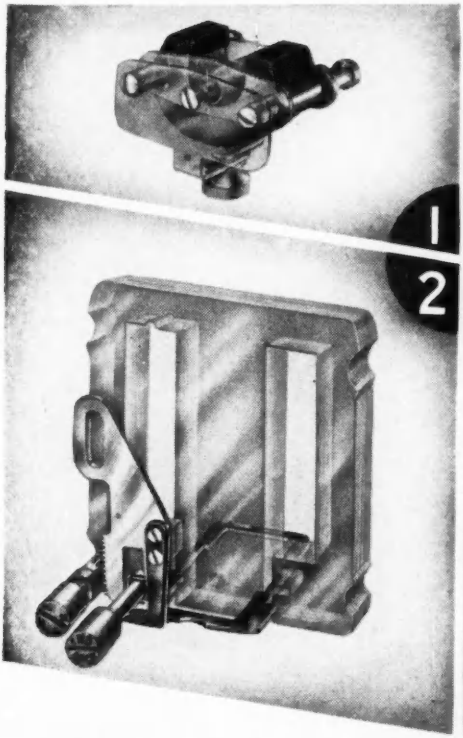
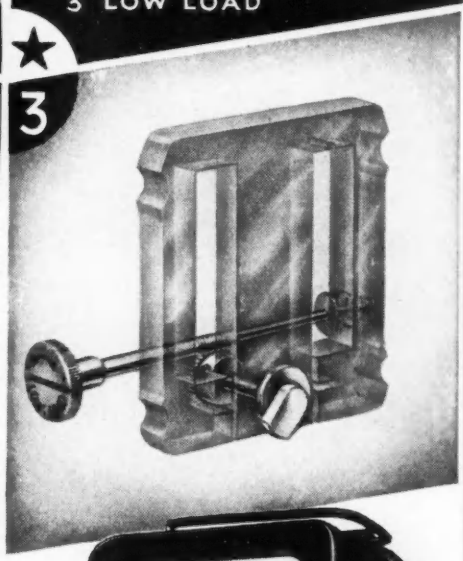


★ ADJUSTMENTS

1 MAIN LOAD
2 INDUCTIVE LOAD
3 LOW LOAD



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All adjustments have a large range, are smooth and positive in action and can be locked.

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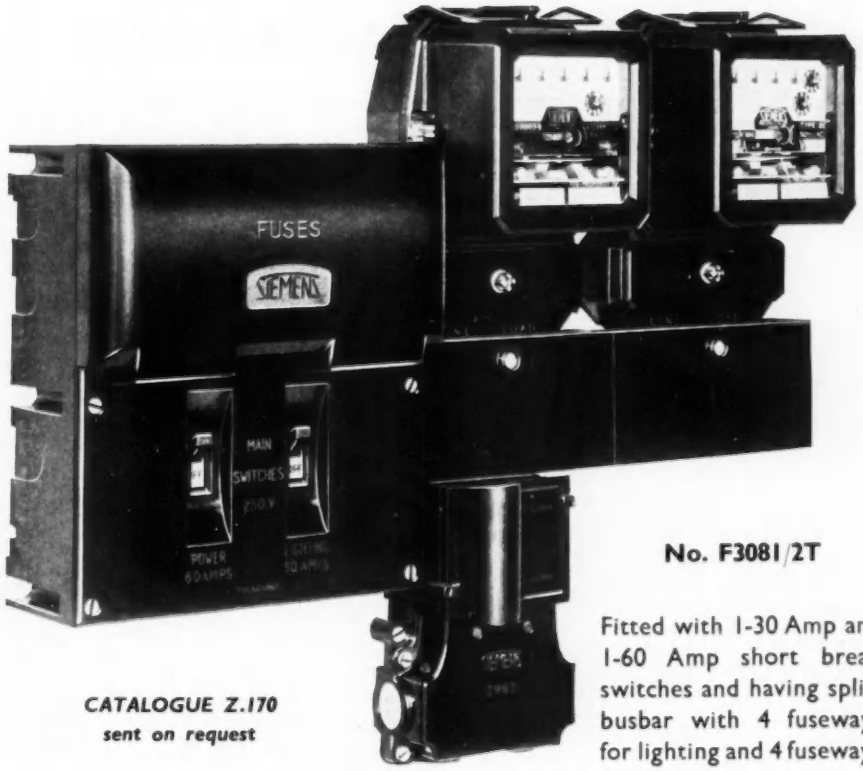
Arranged for two-part Tariff incorporating two Meters. Service Cut-Out and Meter Lead Shields



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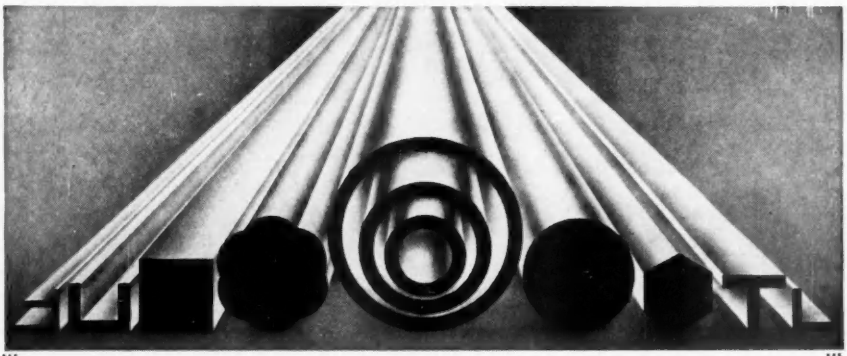

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up to 20% more

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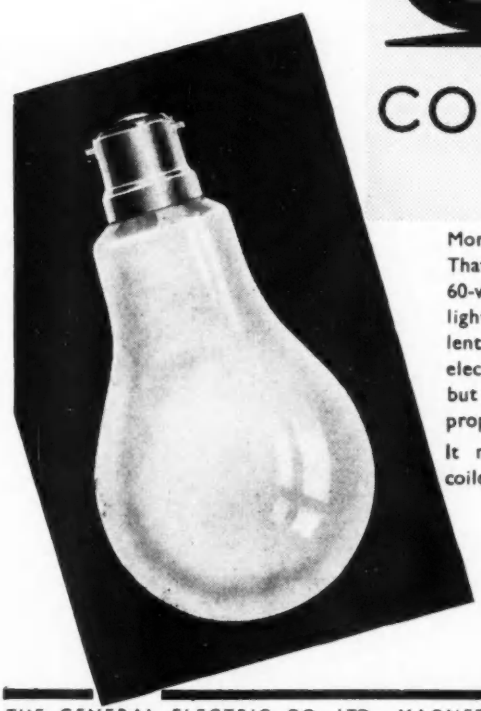

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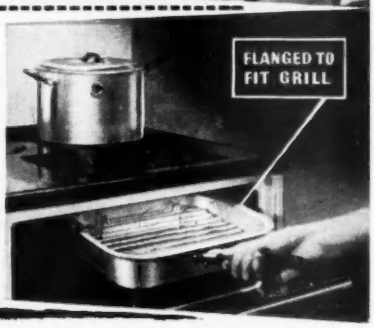
The grill-frypan has wide corners for easy cleaning and is fitted with the special PYRAMID heat-resisting and insulated Bakelite handle.



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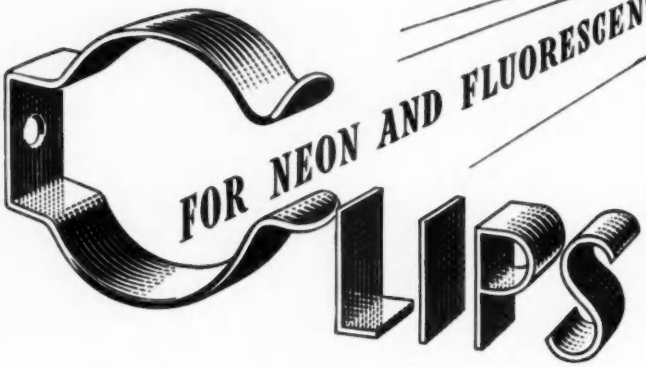

CLIPS

Phosphor bronze neon clips, self-finish or nickel-plated, from 9 mm to 22 mm. Spring steel fluorescent clips, nickel-olated, ½ in. to 1½ in.

Estab. 1919
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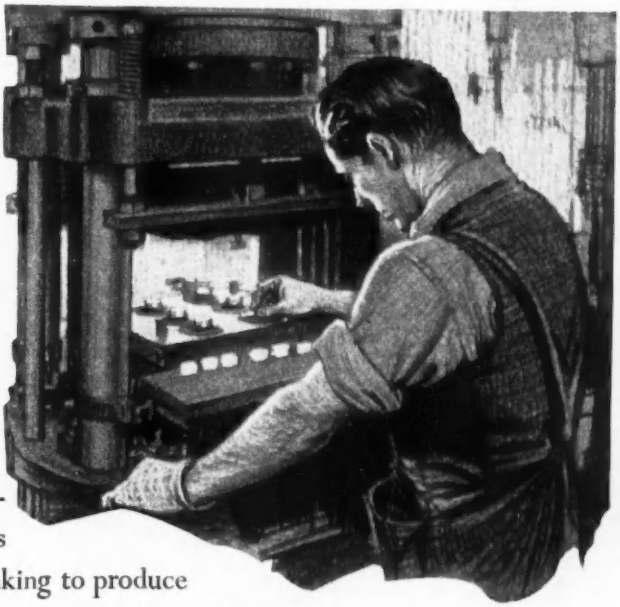

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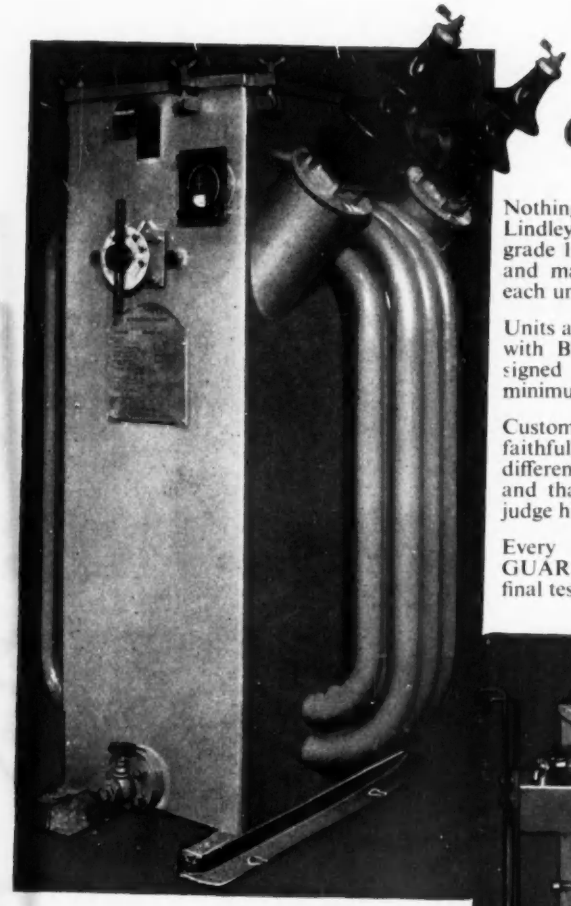

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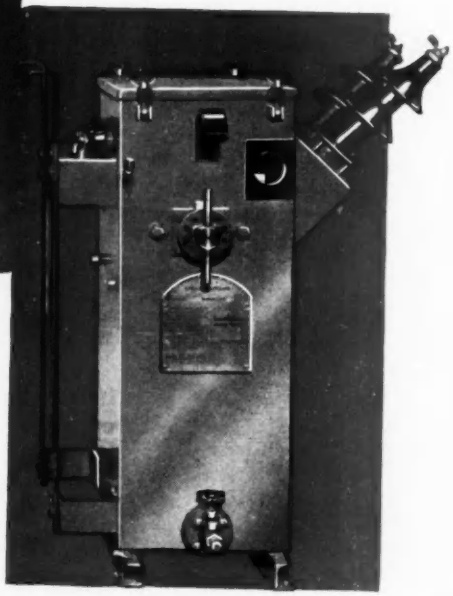

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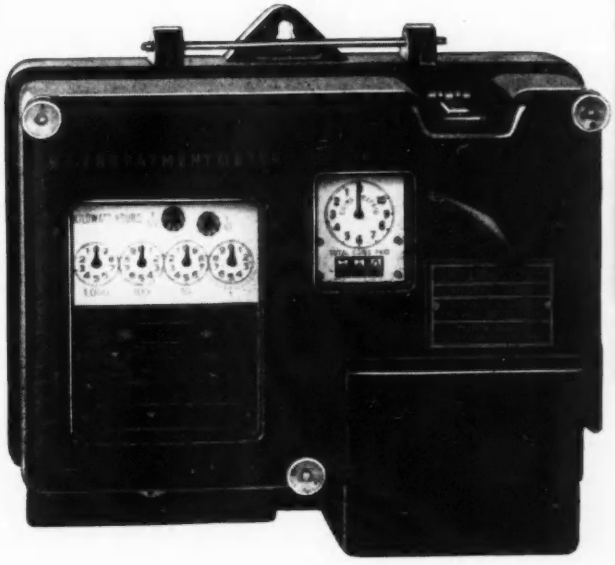

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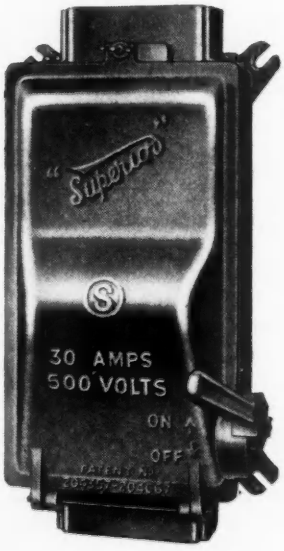

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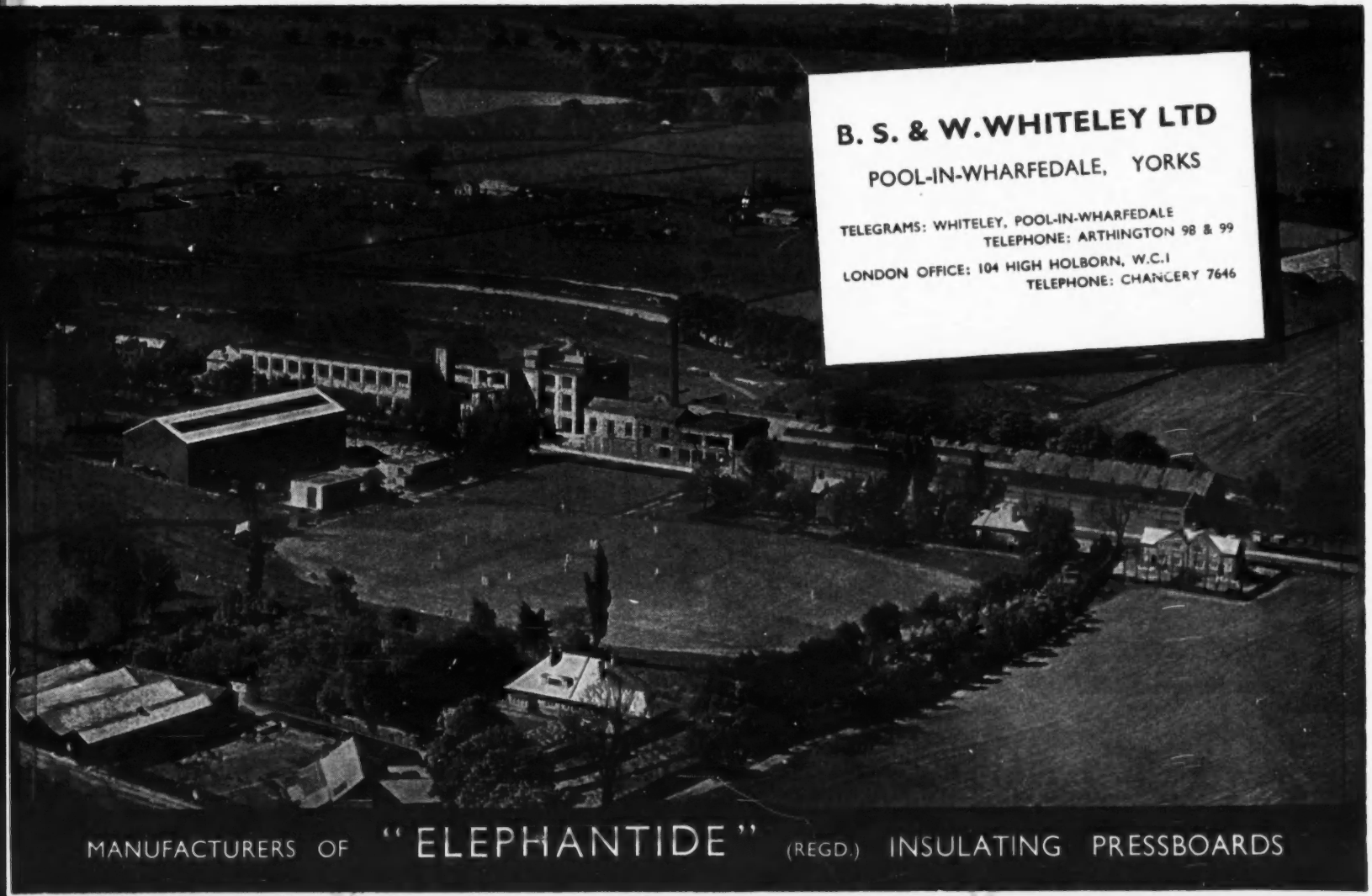
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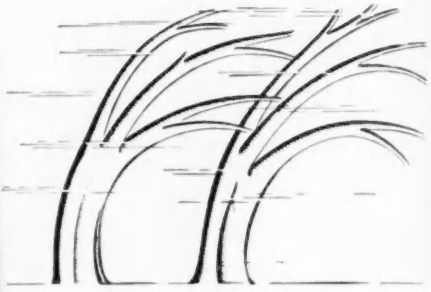
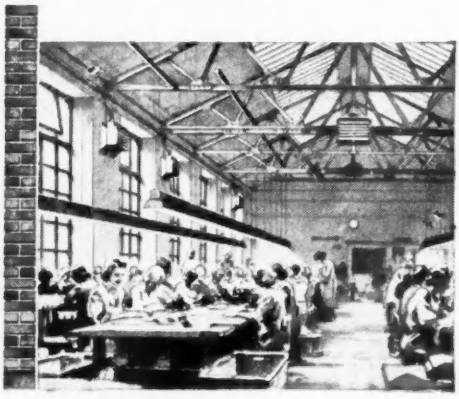
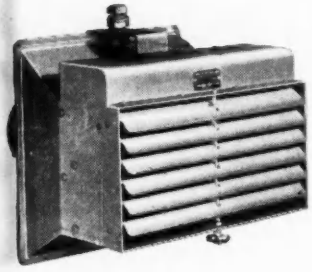




that slows production



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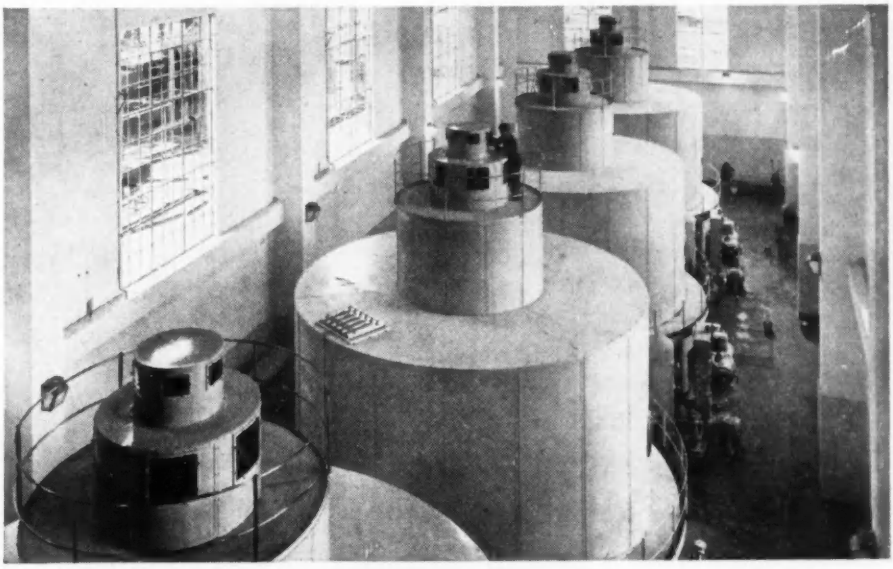

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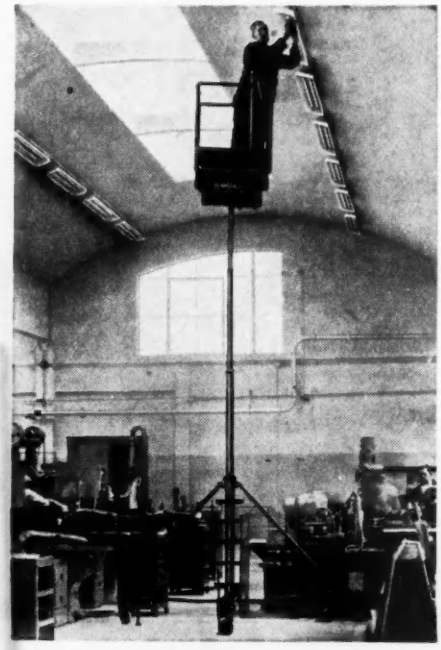

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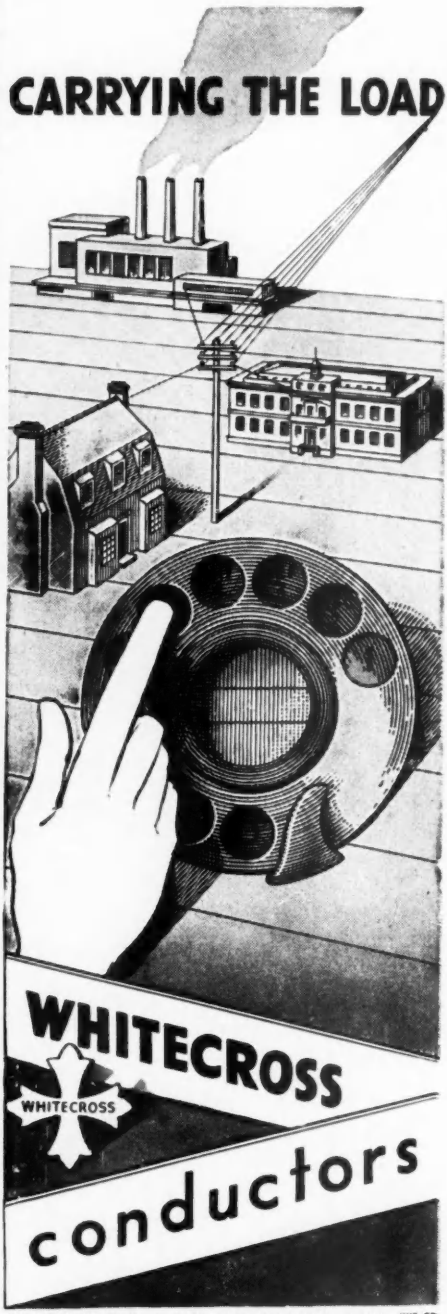

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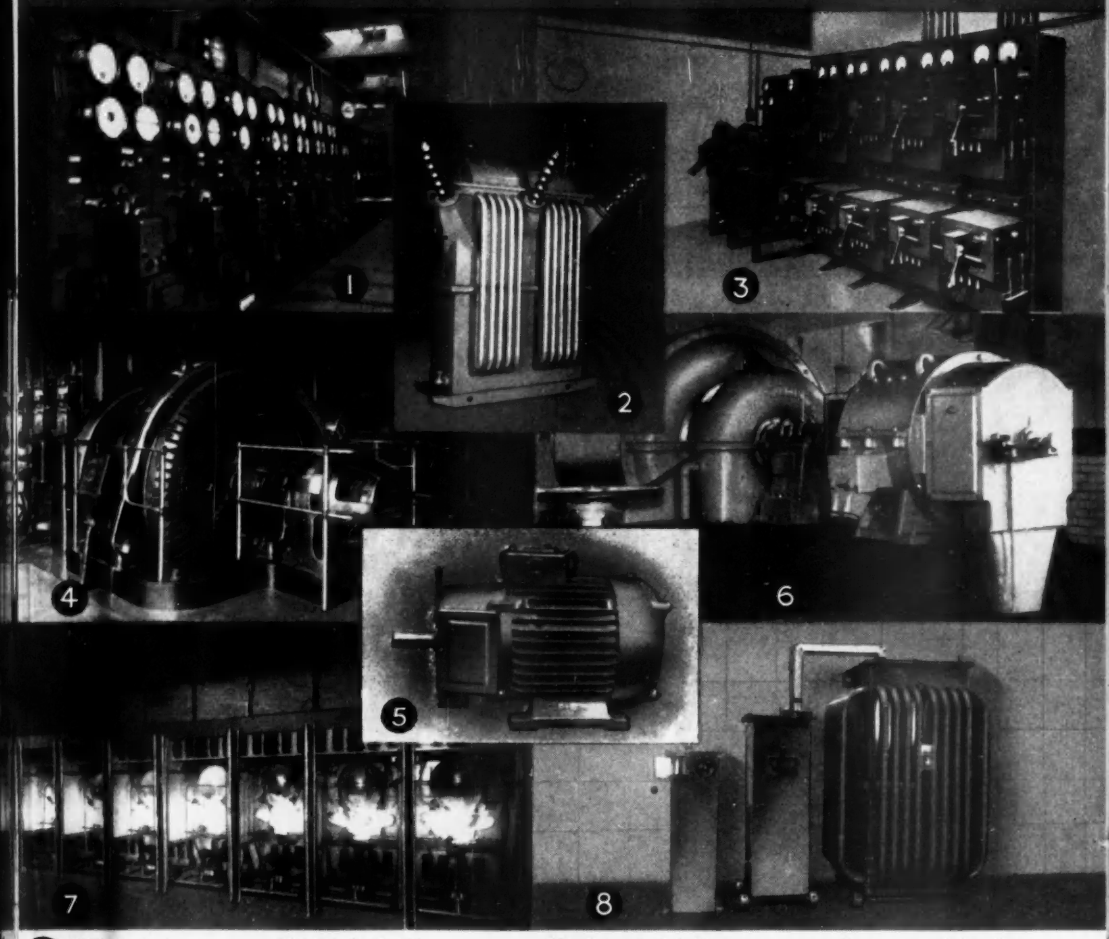

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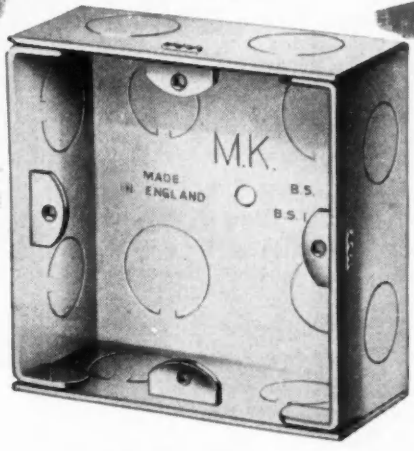

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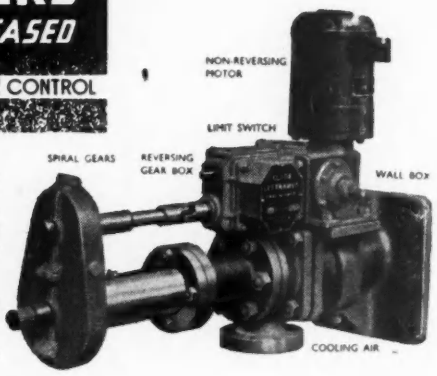

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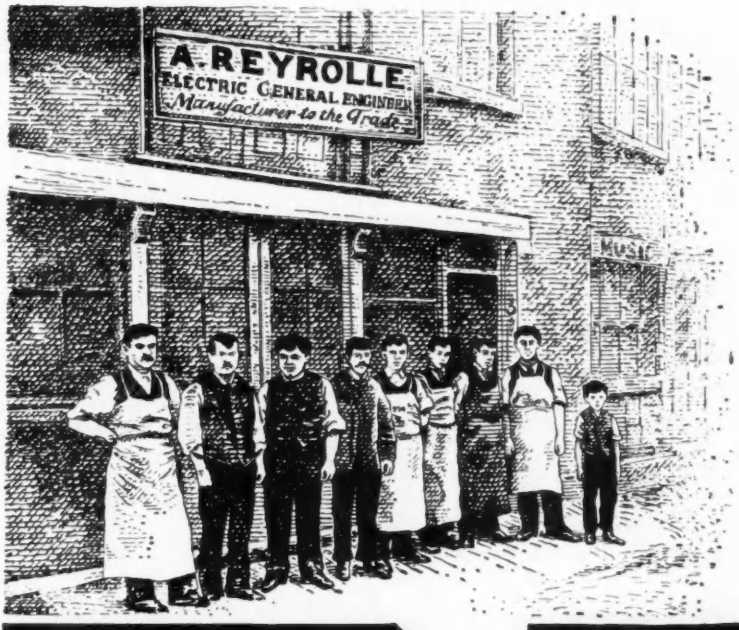

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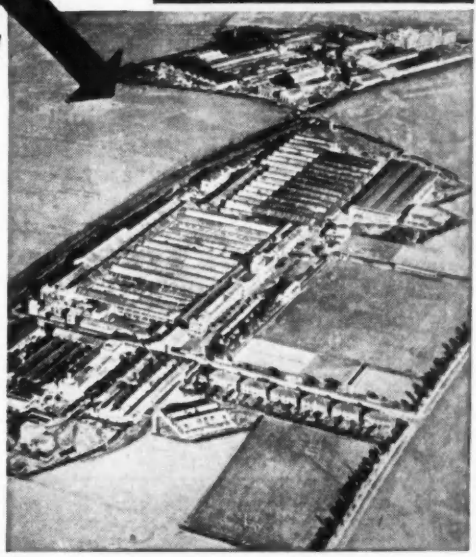

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ELECTRICAL TIMES

Vol. 119 No. 3112 THURSDAY 28 JUNE, 1951

PUBLISHED EVERY THURSDAY

SIXTIETH YEAR OF PUBLICATION

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Editorial

BRIGHTON SESSIONS

WHATEVER may have been the success of this year's convention as a social occasion and an opportunity for those invaluable informal contacts, it is difficult to escape the conclusion that the official sessions were far from satisfactory. In contrast to the presidential address, most of the papers were too general in character for an audience drawn from within the industry, and produced only desultory discussions. It is a damning fact that no more than 13 speakers took part in the discussions during the whole convention, and even one of these was cut short, owing to insufficient time caused by an author reading his paper *in extenso*. The subject before the convention was the utilisation of electrical energy, a field which presents many urgent and vital problems—but not one of these was so much as mentioned during the open sessions. Indeed, it seemed almost as though the papers were selected to avoid any such discussion. This will not do. The problems are there, they will be none the less acute for being suppressed. It seems to have been forgotten that open confession is good for the soul.

WHITHER ?

NEXT year the convention will be the first under the modified constitution and the change will provide an opportunity for reviewing the useful work that can be done at this function. The primary question to consider is the real purpose of the sessions. For whom should they cater? With the present diverse character of the convention it is not possible to interest everyone at every session, nor is it wise to attempt it, so that reviews of a general nature should be eschewed. Although engineers still form the largest group of delegates, most technical papers could more conveniently be presented at the I.E.E. Outside these fields, however, lie the broad economic and political features of the industry, presenting problems deserving discussion on a national basis, and embracing in turn the technical and commercial, the manufacturing and supply sides of the industry. Here, surely, is the convention's forte. Unfortunately the B.E.A. tends to regard these subjects as their exclusive prerogative. Such discussions as take place, do so in camera and manufacturers who may also be concerned have to acquire their information at second hand. A national convention should provide a forum for the discussion of national subjects. Unfortunately, discussions are in the doldrums at the moment. Manufacturers appear to regard the convention discussions as mainly a matter for the supply industry, and members of that industry, even in the higher positions, are showing an increasing reluctance to express their views publicly for fear they may not receive official approval. This way lies stagnation of ideas and the breeding of yes-men. In the B.E.A.'s own interest, therefore, they should do their utmost to encourage complete freedom of expression at the convention. Only by this can the spirit of life be reawakened in the sessions; without it the convention will become moribund.

TWISTING THE RETAIL

NOT satisfied with the views put forward by the independent Lloyd Jacob committee on resale price maintenance, the Government has now announced its own intentions in a White Paper issued last week. These go much further and, if implemented, will deny to any manufacturer the right to specify a retail selling price for his goods. The official statement makes little pretence at objectivity and even shows a disregard for logic, but this is not the place to amplify such criticisms. What must be considered is its impact on our own trade. The intention is to prevent manufacturers

from fixing minimum prices or giving any suggestion of a reasonable sales figure, but no objection is taken to similar predetermination of maximum selling prices. A probable outcome will be for manufacturers to continue to state prices with the prefix "maximum," and then it will remain to be seen whether a trade accustomed for years to selling at fixed values will do other than regard them as ordinary list prices. Indeed, Meteor hopes manufacturers will take such a step. While certain sections of consumer goods are plentiful, others are desperately short, and for manufacturers to depart from fixed price selling under such conditions is to invite exploitation by less reputable traders.

MATERIALS CHANGE-OVER

THE creation of a new Ministry of Materials is a recognition of the serious view the Government takes of the shortage of materials which threatens the industrial life of the country. This concentration of responsibility may ultimately lead to better results, but for some time to come its only effect must be additional confusion, caused by the change-over of ministerial departments. Difficulties will no doubt arise through divorcing responsibility for raw materials from control of the industry concerned but, fortunately, this will provide no new problem to the electrical industry. Finally one cautionary word is necessary, not all materials have been transferred to the new Ministry. Steel allocation remains the responsibility of the Ministry of Supply, and the Board of Trade continues in control of china clay as well as other materials which are not of prime importance to the electrical industry.

BETTER LIGHT . . . PERHAPS ?

THE views on lighting development expressed by Mr. W. Robinson at the E.D.A. Sales Conference received endorsement in a recent speech made the other day by Mr. Willard Brown, director of the lighting division of General Electric (U.S.A.). Commenting on the potentialities of the lighting load, he stated that the lighting consumption in the U.S. had nowadays grown to three-quarters of that consumed by all industry 10 years ago—almost as though the consumer in the U.S. had suddenly become light-conscious on his own account. Here Mr. Brown is surely overmodest in estimating the part played by his own industry in educating the public towards a proper appreciation of the value of good lighting, an education which has been carried out on a vast scale for more than 20 years. Over here, neither individual manufacturers nor the Lighting Service Bureau have been idle. They have preached the gospel with energy and determination and, bearing in mind the disproportion in the forces deployed on the task on different sides of the Atlantic, have achieved results which are gratifying if not spectacular. The major problem facing large-scale lighting development in this country is not any lack of initiative and drive within the industry, but the restrictive effects of agencies outside its control. Anyone undertaking the task of convincing the public of the necessity for more light while other and more powerful agencies are spreading the doctrine of universal restrictions and shortages, will have a hard task before them.

TRIBUTE TO SIR EDWARD

MORE than nine months ago, reference was made to a report of the projected use of hydraulic compressors for gas turbines. The name of Sir Edward MacColl was mentioned as the originator of the idea, which will be remembered by those who attended the I.E.E. Supply Section annual lecture last month. Beyond those two brief references, however, very little information has been available. Our leading article this week was written in consultation with Sir Edward, and was in our hands only a short time before the regrettable news of his sudden death was received. It is with some satisfaction, tempered with regret at his passing, that we are able to offer to our readers a detailed summary of the last investiations upon which he was engaged.

Meteor

Gas Turbines with Hydraulic Compressors

By DAVID MURRAY, B.Sc. (Eng.)

This article was written in consultation with the late Sir Edward MacColl, deputy Chairman of the North of Scotland H.E.B., and outlines the problem on which that distinguished engineer was working immediately prior to his regrettable decease

APART from bridling the wind to move ships, water power was possibly the first source of natural energy ever harnessed by man. It must have been obvious, even to savage man, that a flowing river or a tumbling waterfall possessed great force. Certainly, when he settled down to a semi-civilised life, he very soon devised ways and means of using hydraulic power to raise water for his fields, and to do jobs of the kind.

As the years slipped by he became more ingenious, in due time and place. The early Catalan and Italian iron makers, for example, needed a steady blast of air to blow up their forges. They developed a machine called a "tromp," a kind of hydraulic compressor, which used falling water to deliver a stream of air, without the necessity of pumping gear. In effect, the moving water entangled bubbles of air at one stage and gave them up, under pressure, at another. The principle in reverse is well enough known today; in fact, it is the root principle in the high-vacuum technique which is playing such a part in the lamp and electronic side of industry. Moving jets of oil or steam, passing an orifice, can draw air out of a chamber and create a vacuum. By the same token they can fill the chamber with compressed air if the process is reversed.

The phenomenon depends on the fact that a viscous fluid can enmesh and carry away bubbles of gas. There was a time, long after the perfection of the steam engine, but before electrical engineering had come to anything very much, when the hydraulic compression principle seemed to be going places. At remote mining sites, where fuel was scarce and falling water was plentiful, hydraulic compressors were built to supply compressed air for the various operations. At the turn of the century there were quite a number of installations working in Germany and in North America.

At that time the design principles of the device were not well understood, and working efficiencies were low, running between 50 and 75%, compared with over 90% for a straightforward water turbine. However, one installation at a copper mine in Michigan, U.S.A., delivered the equivalent of 36,000 cu. ft of free air per minute at an efficiency, obtained under test, of 82·75%, a pressure of 128 lb/sq in. (abs) and an effective horse-power of 4,870 h.p. That at least showed the possibility of obtaining very large supplies of compressed air from falling water.

Application to Gas Turbines

It is against that background that Sir Edward MacColl has drawn together notions from widely diverse branches of engineering to make a composite picture. Going on the knowledge that the gas turbine has to feed back much more than half of its shaft energy to drive air compressors, he conceived the idea of supplying the turbine with compressed air obtained from a simple hydraulic compressor.

Naturally enough, the first question is: if it pays, in working terms, to take compressed air out of a waterfall, why not use the pressure head for a straightforward water turbine scheme, and operate it, if necessary, in parallel with a gas turbine? Surely, since one would be lucky to get an efficiency of 80% out of a water compressor, while an efficiency of over 90% is commonplace for a water turbine, it would be better to make the most of the falling water, rather than to use it to produce compressed air, and then to feed that air to a fuel-driven gas turbine?

Several theoretical and practical answers to these questions can be produced. First, the efficiency of a gas turbine working in series with a hydraulic compressor, as a combined unit, is an amalgam of two efficiencies, which provides a remarkably high result. Secondly, there are heads of water which would not be suitable for harnessing direct to some rotary

mover, but which are quite capable of supplying very useful quantities of compressed air. Thirdly, certain engineering advantages are offered. One great disadvantage of the gas turbine is its complexity and, so far as things have gone for the present, its relatively short life. Here is a means of substituting a comparatively simple hydraulic device for an intricate and delicate mechanically-operated, but thermally-powered compressor, or set of compressors, and of doubling up the useful output of the end shaft at the same time. It is even possible to visualise a gas turbine which would work up compression by hydraulic means, rather than by what is, in effect, an air turbine working in reverse. The gas turbine would drive a pump, which in turn would move a circulating flow of water and would provide compressed air. Pump losses would bring about a slight drop in overall efficiency, but this might be more than made up by greater simplification of the system as a whole. The benefit of added power from an independent waterfall would not be available, but the combined thermal-hydraulic unit might be applicable where there is a seasonal variation in water supply and where it might be useful to maintain a constant load at some sacrifice in efficiency.

Elements of Air Compression

The hydraulic air compressor—shown in Fig. 1—is a simple affair, at any rate, in conception. Fundamentally, it consists of two deep tubes, A and B, with an intermediate collecting chamber at the bottom, C. If water is induced to flow down one leg, by an unbalanced pressure head, it will entangle air and draw it down, granted that the water flow is at sufficient velocity. The lower down the bubble, the greater the hydrostatic pressure upon it, the smaller its volume, the greater its density and the smaller its buoyancy.

There is a tendency, in the upper turbulent zone, where little compression has yet been done on the enmeshed air, for some of the bubbles to break back and be lost to the system. This can be overcome by injecting the air well down the leg. Being under immediate pressure, its rate of uplift against the descending water is slower and it is carried down.

As the bubbies go down, they are compressed still smaller, and finally give up the struggle to rise. But if the direction of flow of the water column is suddenly changed, and if its velocity is reduced by entering a large chamber, the air globules re-exert themselves against the viscosity of the water, tend to coagulate, gain buoyancy and are released. The air can then be collected and drawn off through a pipe D. With water weighing 62½ lb/cu ft, the pressure under a head of 230 ft is 100 lb. sq. in. At twice that depth, the pressure is doubled. At this stage, a common comment is that the released air may be very wet, and that the moisture would cause trouble if the compressed air is introduced into a gas-turbine system. In fact, the greater the pressure, the drier the air, as one confirms when thinking back to the ordinary household barometer. Due to the pressure forcing out the water vapour, as it were, the air bubbles at the foot of the column are actually drier than when they enter at the top.

It should be noted that the pressure head, from A to A1 in Fig. 1, determines the amount of air that can be compressed per pound of water passing. The depth A1 to C1, on the other hand, fixes the degree of compression. The two factors are quite separate and have no influence on one another. Another point is that the hydraulic compressor will function perfectly well with a reversed flow. This may have a very important bearing when it comes to harnessing the tides, which ebb and flow twice a day.

One other factor has a vital bearing on the theoretical treatment of the proposition. That is that this type of hydraulic compression of air is to all intents and purposes at a constant temperature. It is isothermal, since the heat generated by compression is continuously taken away by the surrounding water. For

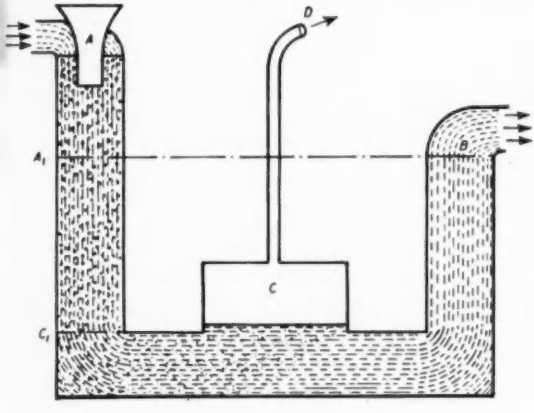
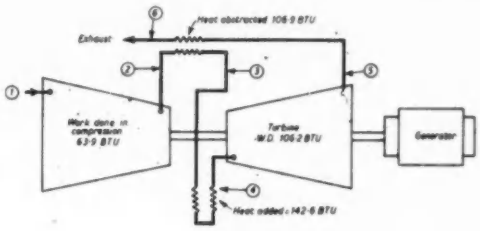


Fig. 1. Fundamental principles of the hydraulic compressor

Fig. 2 (right). Temperatures and pressures for open-cycle gas turbine with mechanical compressor

Point	Pressure lb/sq in. abs.	Temperature ° F
1	14·7	520
2	52	781
3	50	1,211
4	48	1,700
5	16	1,291
6	14·7	861



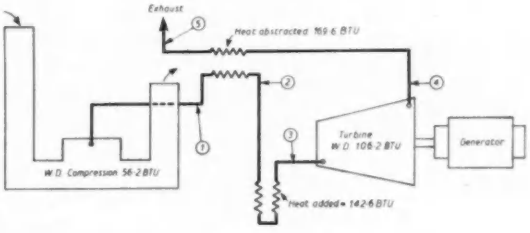


Fig. 3 (left). Temperatures and pressures for open-cycle gas turbine with hydraulic compressor

Point	Pressure lb/sq in. abs.	Temperature ° F
1	52	520
2	50	1,211
3	48	1,700
4	16	1,291
5	14·7	600

all practical purposes, the temperature of the water is not appreciably raised, so that the compressed air is delivered at the incoming water temperature. Much less energy is required for isothermal compression than for the same degree of adiabatic compression (with the compression heat retained), as carried out by either reciprocating or rotary compressors. Sir Edward MacColl calculated that, under perfect conditions isothermal compression absorbs only 73·6% of the energy required for equivalent adiabatic compression. Under practical conditions, one might allow for adiabatic compression being slightly more efficient than isothermal compression, say 87%, against 80%, and for the adiabatic system reaching a still higher efficiency by being done in two stages with intermediate cooling. Even so, isothermal compression has decided overall advantages.

Comparative Efficiencies

Preliminary comparisons can now be made on the basis of an open-cycle gas turbine driving its own compressor, with a heater and heat exchanger as shown in Fig. 2.

As measured at the turbine coupling, excluding auxiliaries, the efficiency of the unit under study runs out at 29·66%. Apart from inevitable losses at the expansion stage, the figures reveal that a very large proportion of the total power of the turbine is used up in the negative work of compression. The proportion is a shade over 60%. Put in simple round figures, if the gas turbine has a gross output at its shaft of 10,000 h.p., the absorption of 6,000 h.p. by the compressor leaves only 4,000 h.p. to be delivered to the attached alternator, or to some other customer. If that negative work could be loaded on to some outside source of compressive power, the output from the same turbine frame would be increased by two and a half times. That was the real goal that Sir Edward had in mind.

Now consider the performance of a similar unit save that an isothermal hydraulic compressor is substituted for the normal adiabatic mechanical compressor, as shown in Fig. 3, the pressure ratios, pressure losses and temperatures being the same as before. The water compressor is assumed to work at 80% efficiency, compared with 87% for the rotary compressor in the first layout. The required air is compressed to the same pressure and abstracts heat from the heat exchanger, before going on to the heater. On these premises, the overall efficiency of the combined unit works out at no less than 53·42%.

If this seems remarkably high, it should be remembered that it is really an issue of the efficiency of the water fall at 80%, together with the gas-turbine efficiency. The compressed air, being at the temperature of the flowing water, rather than heated adiabatically, absorbs more heat from the heat exchanger. The turbine shaft is relieved from losses in compressive work and, there is a higher input of energy, by way of loss of potential in the water fall, over and above the energy put in by burning fuel.

On the ground that an ordinary water turbine has an efficiency of 91%, against only 80%

assumed for the hydraulic compressor, it might legitimately be asked, why not install a hydraulic turbine and run it in parallel with a separate gas-turbine plant?

Taking the gas turbine shown in Fig. 2 as a suitable unit to run in parallel with a water turbine of 91% efficiency, it is found that the overall efficiency of the two separate power sources, regarded as one scheme, comes out at 47%. To make up for the higher efficiency of the hydraulic turbine, the isothermal hydraulic compressor enables the gas turbine to make more effective use of the energy obtained by burning fuel. From the same quantity of water, the net output of power is about 12% less, if water and fuel are used separately, rather than in one integrated scheme, on one shaft.

But a gas turbine working back a single-stage adiabatic compressor is not necessarily the last word in efficiency. A higher efficiency can be achieved by doing the compression in two stages, with intermediate cooling. Fig. 4 shows a gas-turbine arrangement similar to that in Fig. 2, except that the work of compression is spread over two adiabatic compressors, with intercooling. For the working cycle, the in and out pressures and temperatures remain the same. According to Sir Edward's calculations, the burden of negative work on the turbine shaft drops from 60·1% to 57·67% of the total output. As compared with the unit in Fig. 2, the efficiency is stepped up from 29·66% to 31·54%. If such a two-stage compression gas-turbine unit is operated in parallel with an ordinary water turbine, rated at 91% shaft efficiency, and using the same quantity of water as before, the combined efficiency of the two plants, both hydraulic and thermal, is 48·35%. Even that is 9·5% lower, in a relative sense, than for the fully integrated scheme shown in Fig. 3.

By resort to multi-stage compression (and expansion), more efficient gas-turbine cycles can be obtained than those selected for comparison with the hydraulic compressor. But higher thermodynamic efficiency is only achieved at the cost of greater complexity and expense. Apart from capital cost, it sometimes pays to sacrifice efficiency, *per se*, for the sake of greater robustness and lower maintenance charges.

Though there have been great advances in sinking and tunnelling technique, the deep tubes of an hydraulic compressor would add greatly to the civil engineering cost of a completed installation of the double-harness kind. On the other hand, they would replace a set of complicated machinery of short and delicate life by a robust apparatus of long life. That may turn out to be of even more consequence than the fact that if an efficiency of 80% can be obtained in a water compressor, the overall efficiency of an integrated hydro-thermal scheme is higher than that of two independent plants, one hydro and one thermal, running in parallel. Having in mind that a hydraulic compressor was constructed at the Victoria mine in Michigan to run at 82·75% efficiency and was fully tested by Prof. Sperr, it is felt that 80% is realisable under ordinary conditions.

Constant progress, leading to higher efficiencies and smoother running, is being made in the understanding of hydraulic problems. But a main issue is that a gas turbine, and that in its simplest form, can be used to double up the output of a source of hydro power. Or, *vice versa*, a hydraulic compressor can be adapted to double the production from a given gas-turbine frame. It is a case of linking hydro- and thermo-dynamics in efficient double harness. In this small and serrated country, there are plenty of places where the available water power, considered by itself, would be too small to meet the needs of the community. But by applying power derived from burning fuel, the total output can be boosted to approximately double the amount, and stepped into the worthwhile category.

Further Developments

As was said earlier on, Sir Edward had been exercised with the possibility of obtaining compressed air by hydraulic means, but without

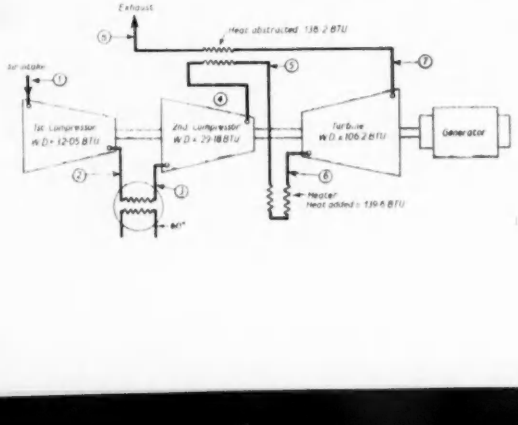


Fig. 4. Temperatures and pressures for gas turbine with multi-stage compressor

Point	Pressure lb/sq in. abs.	Temperature F
1	14·7	520
2	29·4	651
3	27·9	532
4	52	651.3
5	50	1,211
6	48	1,700
7	16	1,291
8	14·7	731.3

the aid of an external waterfall. This idea is shown in Fig. 5. Briefly put, a pump driven by a primary gas turbine induces a circulating

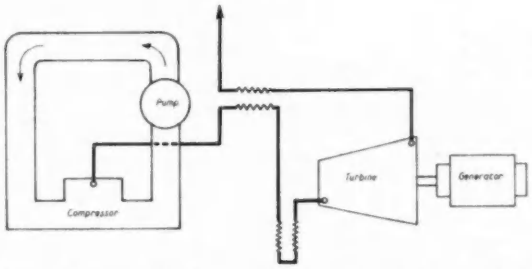


Fig. 5 (below). Open-cycle turbine with pump-operated hydraulic compressor

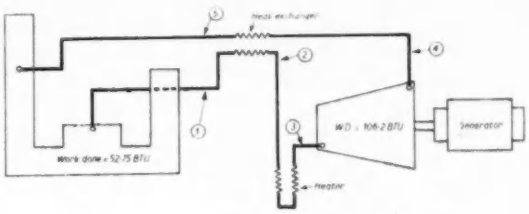


Fig. 6 (above). Temperatures and pressures with exhaust injection into hydraulic compressor

Point	Pressure lb/sq in. abs.	Temperature F
1	96·1	520
2	94·1	1,211
3	92·1	1,700
4	30·7	1,291
5	29·4	600

flow of water, down and up the syphon legs. As with a natural flow, air can be injected, carried down and released under high pressure in an underground chamber. The energy required for the pump, of course, represents negative work and corresponds with the energy needed for the adiabatic compressor shown in Fig. 2. Assuming that the efficiency of the motor and the pump is of the order of 85%, he has reckoned out the overall efficiency of the self-contained hydro-thermal unit at 28·12%. Even allowing for pump losses, this is not much lower than the 29·66% for the arrangement in Fig. 2.

In a closed hydraulic circuit of this kind, the heat of compression added by way of the pump would raise the temperature of the water and take away from the perfection of isothermal compression. Unless additional cold water were introduced to hold the temperature even, it would reduce the efficiency of compression and thus of the complete twin unit. There are places, however, where there is any amount of cold water, though not under sufficient pressure head to overcome the friction in the downtake and uptake and furnish an entangling velocity. At these points, a pump could develop the necessary circulating velocity. As a matter of interest, a hydraulic compressor would require to operate with an efficiency of 82·75% (Prof. Sperr's figure, as it happens) for the self-contained hydro-thermal scheme to break even with the pure thermal scheme, at 29·66%. It has been pointed out that the pumping device could be installed as a sort of standby and brought into commission when the forceful flow of water fails, for one reason or another.

Another method of approach is to consider the outcome of increasing the pressure in the hydraulic system and in the gas turbine. This scheme is set out in Fig. 6. By increasing the pressure in the hydraulic system to 96·1 lb/sq in. abs (52 lb/sq in. abs in Fig. 3), the same pressure ratio of three can be retained in the gas turbine. But the exhaust air is available at 29·4 lb/sq in. abs. This pressure of two atmospheres is sufficient to inject into the moving column of water at 34 ft down the suction leg, that being the height of the water barometer. Calculating from these figures, it takes rather less energy for the required degree of compression and the overall efficiency of the hydro-thermal unit is raised to 54·39% (53·42% in Fig. 3). The total output would be 2·213 times greater than for an ordinary hydraulic turbine having a shaft efficiency of 91% and using the same quantity of water. That compares with an advantage of 2·076 in the case of a water-heat unit taking in air at atmospheric pressure. In the same way, the efficiency of a self-contained hydro-thermal system is raised to 30·96% (28·12% in Fig. 5). The improvement is derived from the lesser amount of energy needed to compress the air, the saving being reckoned at 6·15%.

A closed-cycle gas turbine might be operated with the same pressure and temperature drop as in Fig. 6. Such an arrangement, with a single compressor and an inter-cooler, is shown in Fig. 7. The air is delivered to the compressor at two atmospheres, and the circuit pressures and temperatures are similar to those in the previous example, save that the cooler necessitates a slightly higher pressure from the compressor to keep the ratio of three across the

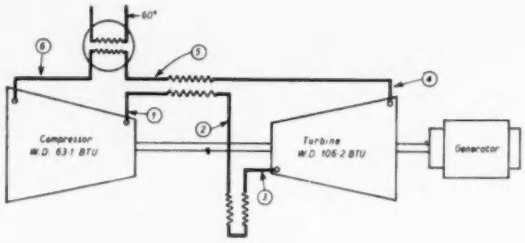
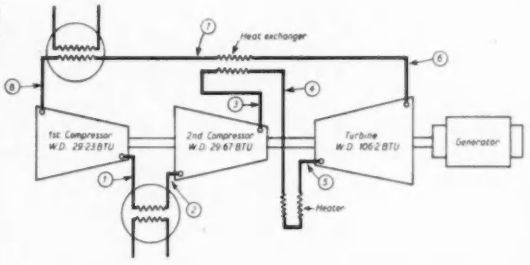


Fig. 7 (on left). Temperatures and pressures for closed-cycle turbine with intercooler

Point	Pressure lb/sq in. abs.	Temperature ° F
1	100·6	790
2	58·6	1,211
3	96·6	1,700
4	32·2	1,291
5	30·9	875.2
6	29·4	532

Fig. 8 (on right). Temperatures and pressures for closed-cycle turbine with two-stage compression

Point	Pressure lb/sq in. abs.	Temperature ° F
1	55	651.5
2	53·5	532
3	100·6	653.3
4	98·6	1,211
5	96·6	1,700
6	32·2	1,291
7	30·9	733.3
8	29·4	532



turbine. The thermal efficiency of this arrangement has been calculated as 30·22% (29·66% in Fig. 2).

If the compression is divided over two compressors, with inter-cooling, as in Fig. 8, there is an additional thermal gain. The air pressure has to be slightly increased to overcome the circuit resistance of the inter-compression cooler. The negative work takes rather less energy than in Fig. 7 and the efficiency moves up to 33·17%. If this two-stage compression closed-cycle gas turbine were operated with a straightforward water turbine of 91% shaft efficiency, as indicated in other examples, the overall efficiency of the parallel system would be 49·51%. Even that is 9·8% relatively lower than for the closed-cycle water-compressor arrangement set out in Fig. 6.

Closed-Cycle Turbines

All the previous examples have been based on certain assumptions for the efficiency of turbines, compressors, heaters and heat exchangers.

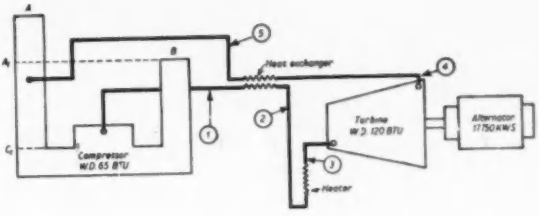
But the North of Scotland Hydro-Electric Board, of which Sir Edward MacColl was deputy chairman and chief executive, has placed an order with John Brown and Co. Ltd., of Clydebank, for a large closed-cycle gas turbine of Escher-Wyss design, rated at 13,750 kW. A full budget of design data, subject to the manufacturer's guarantees, is therefore available. The schematic layout of this well-known system is shown in Fig. 9, all the pressures and temperatures being calculated by the builders. A low-pressure turbine drives the alternator and the first compressor, and a high-pressure turbine drives three other compressors, all four compressors functioning adiabatically. The negative work of compression absorbs 56·1% of the total output. As the result of this and other energy losses, the shaft efficiency (neglecting auxiliaries and the combustion circuit) falls out at 35·7%. The considerable amount of work done by the h.p. turbine is entirely taken up by the three compressors on the same shaft. And, from the furnished information, just on 22·6% of the output of the bigger l.p. turbine goes the same way, doing negative compressive work. If this work could be loaded on to some other agency, the available output from the same machine would be 17,750 kW, an increase of 4,000 kW.

A possible way of doing this is shown in Fig. 10, where a hydraulic compressor does the jobs undertaken by the four mechanical compressors and the h.p. turbine of Fig. 9. It also cuts out the four inter-coolers and the h.p. heater, and avoids a pressure loss in the circuit of 32 lb/sq in.

Assuming the same efficiency for the heater and the heat exchanger, and the same maximum temperature in both schemes, and on the basis that the hydraulic compressor is designed to deliver air to overcome the frictional and other losses in the system and to give the same heat drop through the turbine, the efficiency of this type of combined hydro-thermal unit works out at 53·98%. That gives 2·029 times

Fig. 10 (right). Temperatures and pressures for hydraulic equivalent of Escher-Wyss cycle

Point	Pressure lb/sq in. abs.	Temperature ° F
1	284	520
2	269	1,170
3	255	1,710
4	67·5	1,248
5	66	589



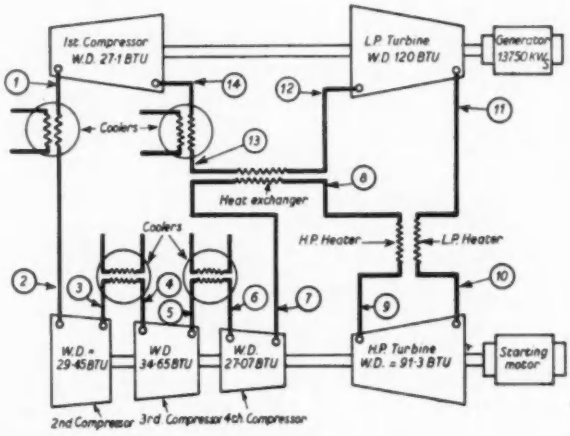


Fig. 9 (on left). Temperatures and pressures for Escher-Wyss cycle

Point	Pressure lb/sq in. abs.	Temperature ° F
1	117	630
2	114	532
3	216	653
4	211	532
5	426	674
6	423	532
7	745	643
8	730	1,170
9	710	1,702
10	269	1,340
11	255	1,710
12	67·5	1,248
13	66	712
14	65	528

as much useful energy as a hydraulic turbine making the most of the same pressure head and quantity of water at 91% shaft efficiency.

If this same water turbine were operated in parallel with the Escher-Wyss set shown in Fig. 9, the overall efficiency would be 46·85%, giving a clear lead to the integrated hydro-thermal unit.

The scheme in Fig. 10 is postulated on an air pressure of 284 lb/sq in abs. To obtain this by hydraulic means would entail going down to a depth of no less than 622 ft, apart from the unbalanced head necessary to overcome friction and impart velocity. The down and up legs might well be housed in the same excavated shaft, separated by a division wall. Even at that, it would be a costly civil engineering job to sink a shaft to this depth (as deep as many a coalmine) and to cut out a collecting chamber at the bottom.

But, as set out in Fig. 11, the compression work might be shared between two compressors, one isothermal and hydraulic, the other adiabatic and mechanical. A pressure depth of 354 ft would give 152 lb/sq in. abs. and the linked adiabatic machine could work this up to 284 lb/sq in. abs. before passing the compressed air through the heat exchanger and the heater to the turbine.

The Victoria Compressor

Sir Edward MacColl agreed that his lively interest in the new project was primed by the data which came into his possession concerning the hydraulic compressor which was actually in action at the Victoria copper mine, the one tested by Prof. Sperr. That was at some height in the mountains, where the barometric pressure was a little less than at sea level, thus necessitating a slight adjustment in the figuring.

The characteristics of that water compressor are as shown in Table 1.

TABLE 1.

Depth of compressor shaft	343 ft
Depth of return shaft	271 ft
Gross hydraulic head...	72 ft
Net hydraulic head	70 ft
Water—cu. ft per min, one shaft	14,820 cu. ft
cu. ft per min, three shafts ...	44,460 cu. ft
Total potential power in falling water, one shaft	1,961 h.p.
Total potential power in falling water, three shafts	5,883 h.p.
Air—velocity of air from compressor	49.74 ft per sec
cu. ft of air per min at 14 lb/sq. in. abs.	35,790 cu. ft
compressed air pressure ...	128 lb/sq. in. abs.
temperature of water and air	60° F
Developed horse-power, three shafts ...	4,869 h.p.
Efficiency—air to water	4,896/5,883=82.75%

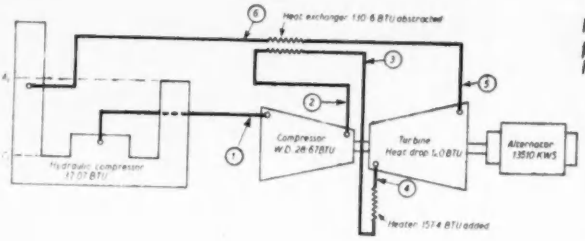
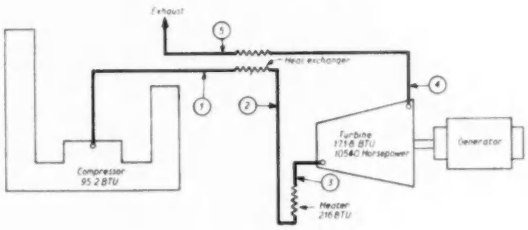


Fig. 11 (left). Temperatures and pressures for cycle using combined hydraulic and mechanical compression

Point	Pressure lb/sq in. abs.	Temperature ° F
1	152	520
2	284	637.2
3	269	1,170
4	255	1,710
5	67·5	1,248
6	66	706

Fig. 12 (right). Temperatures and pressures using the Victoria hydraulic compressor

Point	Pressure lb/sq in. abs.	Temperature ° F
1	128	520
2	126	949
3	124	1,700
4	16	1,029
5	14·8	600



The compressor had three vertical shafts, with the idea of stepping up the air horsepower, as required. Careful tests were carried out on one shaft only. When in full operation the total output in compressed air from the three shafts was equivalent to 4,869 h.p. If the same water had been put through an ordinary water turbine, at 91% efficiency, the performance would have been 5,355 h.p., quite considerably more than by hydraulic compression. However, the need was for compressed air for use in the mine, and there would have been a drop in providing this from air pumps driven by the rotary water turbine.

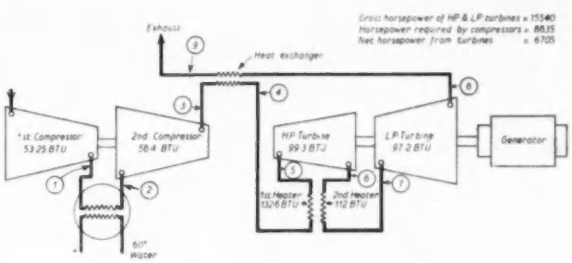
If the compressed air from the Victoria water compressor had been fed into a gas turbine, in line, the total output would have been very much greater. Using the arrangement indicated in Fig. 12, it is calculated that the total gas-turbine output would be 10,540 h.p., or almost twice the production of a straightforward hydraulic turbine working on its own. The overall efficiency of the integrated hydro-thermal installation would be 55·1%. That takes account of the heat supplied by burning fuel, and of the heat equivalent released by the falling water. Taking fuel oil at 18,500 B.Th.Us./lb, the fuel consumption per hour would run out at some 1,824 lb. That is only ·173 lb per shaft horse-power hour, an extremely favourable figure for an installation in the hills where it would be difficult to transport oil fuel.

An even more efficient arrangement can be conceived, as shown in Fig. 13, where the available pressure drop is spread over two working gas turbines, with a reheat stage in between. On the basis that there is no change in the quantity of compressed air put out by the hydraulic compressor, the power is pushed up to 12,060 h.p. There is a slight increase in the circuit pressure loss due to the introduction of a reheater. Against that, the reheater adds more energy and there is a better utilisation of the pressure drop. That leads to more output and increased efficiency, the latter being put at 57·72%. This arrangement provides 2·252 times the horse power of a straight running hydraulic turbine, using the same water.

The gas turbine visualised in Fig. 13 might be provided with two adiabatic mechanical compressors, as in Fig. 14. Over the same pressure and temperature range, and with two-stage compression and two-stage expansion, the thermal efficiency, leaving aside the auxiliaries, would come out at 34·68% at the turbine shaft. Now, if the Victoria water were put through an ordinary water turbine, it would, as calculated before, develop 5,355 h.p. To raise this up to the 12,060 h.p. (as in Fig. 13), a gas turbine running in parallel would have to subscribe no less than 6,705 h.p. To get this net addition would involve doing 8,835 h.p. of negative work in the adiabatic compressors. In short, the turbine must be capable of turning out a gross output of 15,540 h.p.

Fig. 14 (right). Temperatures and pressures utilising twin turbines with reheat and mechanical compressors

Point	Pressure lb/sq in. abs.	Temperature ° F
1	42	740
2	40	532
3	128	770
4	126	1,247
5	124	1,700
6	45	1,319
7	43	1,700
8	16	1,327
9	14·8	850



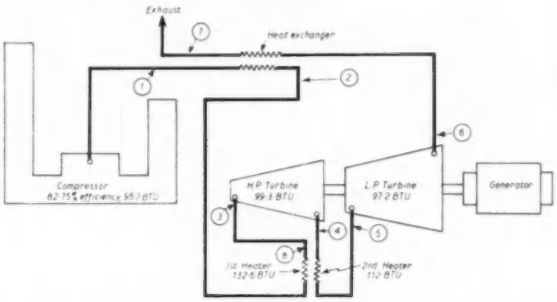


Fig. 13 (left). Temperatures and pressures with hydraulic compressor and twin turbines with reheat

Point	Pressure lb/sq in. abs.	Temperature ° F
1	128	520
2	126	1,247
3	124	1,700
4	45	1,319
5	43	1,700
6	16	1,327
7	14·8	600

If this big complicated two-stage gas turbine were operated in parallel with a water turbine using the Victoria water, the overall thermal efficiency would be 47·8%. For the same net power from the turbine shafts, namely 12,060 h.p., that is less than the 57·72% for the fully integrated hydro-thermal installation (Fig. 13).

In working out the examples, shown in Fig. 12 and Fig. 13, Prof. Sperr's test results for the Victoria hydraulic compressor are assumed to be correct. His efficiency is actually a good deal higher than for three or four other water compressors. But an examination of the various designs reveals that the Victoria apparatus had proportions which lent themselves to a better separation of the entangled air from the water, and consequently to higher efficiency.

There seems no reason why these proportions cannot be duplicated or even improved. For example, a great deal more is now known about air and water viscosities, about streamline flow, critical velocities and other factors of the kind. Suitably treated water might have a greater entangling efficiency, and suitably designed tubes and chambers might have a greater disengaging efficiency.

Sir Edward MacColl agreed that his examples were based on the most efficient gas turbine and adiabatic compressor practice, and might be taken to be on the high side under practical conditions. But since the calculations have been reckoned on an even basis, they give a true comparison between gas turbines taking air from hydraulic compressors and similar machines dependent on adiabatic compressors for an equivalent supply.

The various examples cover both closed and open cycles for the gas turbine, though an external heater is employed in each case.

Throughout, the air pressures are given in pounds per square inch absolute, and the temperatures in degrees Fahrenheit absolute. Save in the case of Fig. 9, where the air pressure losses are those supplied by the gas-turbine builders, and are presumed to be calculated, the pressure losses in the air circuits have not been expressly figured out. Being rather token contributions, they are perhaps somewhat lower than would be obtained in an actual gas-turbine installation. But the utmost consistency has been maintained in the various examples and the relative characteristics of isothermal and adiabatic compression remain unaltered. It should be borne in mind that electrical losses are not included, outputs being calculated at the turbine shaft.

Taking advantage of the fact that a hydraulic compressor might function equally well in both directions, a scheme is under examination to associate a gas turbine with tidal power. This would enjoy the same benefit of doubling up the power derived from heat or from flowing water. There are many points on the coast of Scotland where a tidal-thermal scheme might be applicable.

B.B.C. Research

Fundamental work is carried out at Kingswood, Surrey

THE need for a Research Department to deal with fundamental problems arising out of broadcasting made itself felt as long ago as 1929. By 1934, this Department was housed at Balham, where it remained until the outbreak of war. The war itself made further long-term research impossible, with the result that after hostilities ceased the Research Department was faced with a considerable back-log. Further, the rapid expansion of television provided a development field of large proportions. Search was therefore made for larger and more suitable premises, which were eventually located at Kingswood Warren, near Banstead—a mansion of suitable size standing in some 27 acres of grounds. In addition to the mansion itself, plans were made for the erection of two laboratory blocks, of which one has been built.

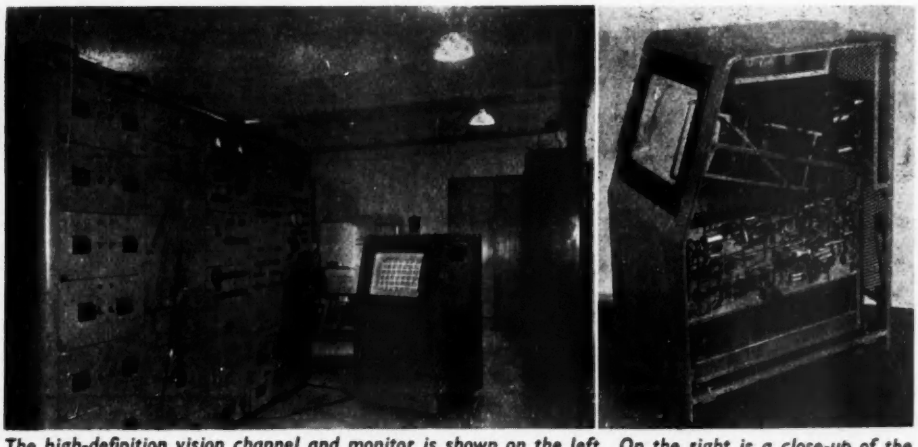
Organisation

The main function of the Department is to provide the solution to technical problems of broadcasting both of sound and of vision, and in consequence a wide field has to be covered. As much of the equipment required for this work has to be specially built, there has been provided a model shop, fully equipped to undertake the construction of the great majority of the equipment required by the various sections. This ranges from individual pieces of test equipment up to large bays of panel-mounted equipment. Care has been taken, as far as is possible, to keep in touch with research workers in similar or allied fields, so that the duplication of work may be avoided.

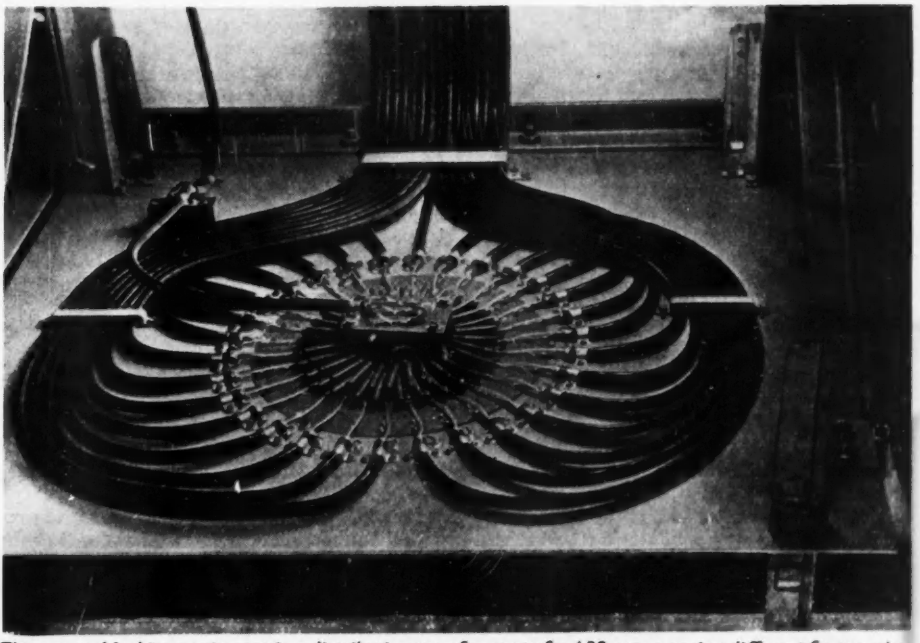
Television Research

The main programme being undertaken is a general investigation into high-definition and colour systems in order to attain an appraisal of the most desirable standards in relation to the economic and technical factors concerned. Although fundamental research into the design and construction of the tubes used in the television camera is undertaken by the manufacturers' research departments, facilities are available at Kingswood for the testing and calibration of such tubes.

In order to secure an assessment of the whole t.v. field, the laboratory has installed three complete vision channels. One of these is a high-definition channel, which is extremely flexible, as it enables either interlaced or sequentially scanned pictures to be produced with various standards of definition up to about 1,000 lines. Experiments have been carried out to demonstrate the effects of common-wave interference, a phenomenon which arises when a frequency channel is shared by two transmitting stations. Work is also being done on interference caused by ignition systems. In this connection, a "mock up" of a six-cylinder engine has been made, using standard electrical ignition components. The plug points can be



The high-definition vision channel and monitor is shown on the left. On the right is a close-up of the monitor to show the internal construction



This unusual looking equipment is a distribution transformer to feed 30 sets covering different frequencies from a common wide band aerial system

seen visually and can be made to operate at pressures up to about 100 lb/sq in. It is interesting to see the changes in the appearance of the spark as the pressure increases. At atmospheric pressure, the spark is thin and blue; as the pressure is built up it becomes fat and white, until, at about 70 lb/sq in. it ceases—quite suddenly—to be visible. That energy is in fact being emitted is obvious from readings of current, and by the undiminished interference. It would, however, appear that there exists a considerable amount of work yet to be done on both ignition phenomena, as well as interference suppression.

Colour is being actively investigated using a sequential scanning system. In this method, a disc divided into the three primary colours is interposed between the lens and the tube in the camera, and a similar (although larger) disc is interposed between the viewer and his cathode-ray tube. The discs are driven by synchronous motors. In the example at Kingswood, the two motors are kept in synchronism by the mains frequency. One of the main difficulties associated with this type of colour transmission is the matching of the primary colours with the fluorescent phosphor on the face of the cathode-ray tube.

At the same time, work is continuing on colour fidelity, methods of colour analysis and synthesis, and fundamental physiological aspects of the problem, such as the effects of colour flicker and visual acuity.

On the technical side the main difficulty is to keep the signals down to a minimum bandwidth, and this is being carefully investigated.

V.H.F. Transmissions

A certain amount of attention has been attracted lately by the very-high-frequency transmissions being experimentally broadcast from Wrotham, and while the department is not directly concerned with the development of receivers for these frequencies, it has, nevertheless, designed a special-purpose standard F.M./A.M. receiver used for testing the Wrotham programmes, and also a comparatively small F.M. receiver, to show that this type of set need not necessarily fall into the luxury price range.

Field-strength measurement is, however, the direct concern of the department, and for this purpose a comprehensive set of mobile equipment is used. For vertical polar diagram measurement in the medium waveband, a helicopter is utilised, and for ground plotting purposes vans with special non-metallic bodies have been built.

Aerials for v.h.f. and television have been mainly designed by manufacturers, but much work remains to be done, particularly on slot aerials, and medium-wave anti-fading arrays.

Electro-Acoustics

The section dealing with electro-acoustics is responsible for experimental and research work connected with studio design. In this field, a fundamental difficulty in the past has been that what is heard by the ear does not often agree with the result of measurements. New methods of measurement and new techniques have therefore been evolved in an attempt to obtain better correlation. The new technique is to study the response of a studio to transient sounds, using equipment which displays the result on a cathode-ray tube. One method involves the use of pulses of tone of any selected frequency, the duration of the pulse being variable so that with a short pulse the echoes can be investigated; or by lengthening the pulse a steady state condition can be reached.

Apart from the question of studio design, the section also investigates microphones, loudspeakers, audio-frequency equipment, and the general problem of sound in relation to broadcasting. Of particular interest is the work being done on disc high-fidelity recording, and on magnetic tape recording. The phenomenon of magnetic printing, both accidental and intentional, is being studied. Accidental printing between the layers of a reel of tape, after recording has proved troublesome in the past, and means for markedly decreasing this effect have been devised.

The development of a type of magnetic fluid braking is also in progress. This system possesses ideal properties for use on magnetic recording machines which are required to stop very quickly and once having stopped, to be held stationary so as to avoid the formation of loose loops of tape which are liable to break on re-starting.

Finally, this department is interested in "wow" on recording systems.

Jubilee of the B.S.I.

Banquet and Conversazione Conclude the Celebrations

THE advantages of standards in helping to relate price and quality were just as applicable to the international field as to domestic trading, said SIR JOHN ANDERSON (President), at the Jubilee banquet of the British Standards Institution at the Guildhall on Wednesday of last week.

Agreement on standards at the international level got rid of some of the artificial barriers obstructing trade, he continued, instancing the lessons learned in the last war regarding British and American screw threads. The B.S.I. had a large and continuing contribution to make to the national economy, and looked for adequate Government support and interest. The B.S.I.'s activities were specially important today when the Chancellor had budgeted more than eleven hundred million for the defence programme. Only by improved productivity could this be met, while maintaining export production and a good standard of living.

Replying, the Chancellor of the Exchequer, MR. HUGH GAITSKELL, said that the Government had accepted, in principle, the recommendations of the Cunliffe Committee, but, in view of future uncertainty, the term was to be reduced to three years instead of the five recommended—with further consideration at the end of the term. The amount of assistance would also be lower than that recommended by the Committee, i.e., £90,000 minimum for 1951-2, and amounts equal to industry's contributions thereafter, with a maximum of £150,000.

Productivity, the Chancellor continued, must not be thought of solely as saving manpower—it also entailed consideration of economy in raw materials, and in this the B.S.I. could play a special part in revision of standards where necessary to use less material or to substitute other materials. While one could rely on many industrial firms working out their own problems, something more was needed—a wider sharing of industrial knowledge and techniques, than which nothing could be more important for the prosperity of the free world.

The health of the Lord Mayor of London, ALDERMAN DENYS LOWSON was proposed by SIR WILLIAM LARKE (Past-President) who referred to the origin of standards in the Guilds. Replying, the Lord Mayor emphasised the worthiness of the B.S.I. as a successor to the Guilds.

Overseas visitors had their health proposed by MR. HERBERT MANZONI (Chairman, Building Divisional Council, B.S.I.) and MR. C. M. BOWDEN, New Zealand's Minister of Industries and Commerce, replied. Toast of "The Institution" was proposed by MR. GEORGE STRAUSS Minister of Supply, and the response was by MR. ROGER DUNCALFE (Chairman, General Council).

The Conversazione, held in the Natural History Museum, on Friday evening, provided an opportunity for the overseas delegates to meet a large number of the members and senior staff of the Institution, and to view again, if they so desired, the exhibition at the neighbouring Science Museum (reviewed in last week's issue). It provided a fitting conclusion to a half-century of useful endeavour in the field of international co-operation.

Our readers' views ...

Co-operation

IN your issue of June 21 a correspondent, Mr. L. J. Bradley, comments on Megohm's remarks concerning employer-employee relationships, and attempts to impress readers with the weight of his opinions by stating that he sees both sides of the story as foreman on the job.

With due respect, my impression of Mr. Bradley's letter is that he sees only one side of the picture—that of the operative—and for a foreman he appears to be particularly uninformed. He says, for instance, that "any increases have been forced out of the employer by the employee" and then exhorts contractors to "try giving something with good grace and you will be rather surprised at the amount of co-operation that can be had in return." Is he aware that the National Federated Electrical Association offered the April wage increase without any application from the Electrical Trades Union, and has he read—or forgotten—that the Agreement states:—

"*Whereas*, The National Federated Electrical Association

(*a*) having given due consideration to wages levels and earnings in industry generally,

(*b*) having regard to the increased cost of living,

(*c*) being desirous of awarding fair and equitable rates in return for the maximum productive effort,

has offered a wage increase of 4d. per hour in the London area and 3d. per hour in the remainder of the Country.

"*And* whereas the Electrical Trades Union has accepted this offer....."

L. C. Penwill,

NATIONAL FEDERATED ELECTRICAL ASSOCIATION — *Companion I.E.E.*

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Stranglehold

THE report of the B.E.P. Conference at Brighton, which appears in your issue of June 21, will, when read in conjunction with Meteor's editorial, create interest to readers who are concerned by the calamity which has overtaken the electricity supply industry. At this stage the reason for the disaster is of comparatively little importance whilst the wisest way of dealing with it is of supreme significance.

I regret having no knowledge, other than that gleaned from your short report, of what my clever young friend, Mr. Norman Elliott, said when addressing the Conference, for it may be that he supplied figures which are essential to proper consideration of a difficult problem. Nevertheless, Mr. Elliott did say that "rationing by price by a penal charge for space heating would immediately involve the provision of separate heating circuits and separate metering" and that statement is indisputable.

The fact remains, however much we may regret it, that load shedding must continue indefinitely unless the control of maximum demands are brought about : (1) by economic rates being charged to consumers with poor load factor demands; (2) by some form of load control; (3) by some other method.

To install additional generating plant and strengthen transmission and distribution systems for the purpose of overtaking poor load factor demands and to continue making charges anything like those that have been or are being made is economic madness, although it would appear that such a step is contemplated. To do so means that the consumers with good load factor demands will have to help pay for electricity supplied to consumers with poor load factor demands, and although it may be possible to hide the fact, I fail to see how it can be justified.

A. J. Fippard,

ELECTRIC SUPPLY CORPN. (OVERSEAS) LTD. — *M.I.E.E. Chairman*

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Purchase Tax

IN view of the disagreement expressed with Mr. Rayment's views on P.T. I would like to offer him my support.

The purchaser is not interested in how the price of the article he buys is made up, only in the actual amount he has to pay. If Mr. Barfield's idea were followed to its logical conclusion, price tickets etc., should include a complete list of labour, raw materials, overheads, profits etc. as well as P.T.

J. K. Maynard

BLACKHEATH

Notes on Wiring
by MEGOHM

RING CIRCUITS

Some Relevant Regulations Reviewed

RECENTLY a case was brought to my attention where a contractor's electrician was instructed to install a ring circuit comprising 7/·029 v.r.i. cables to serve six 15-amp 3-pin switch sockets and plugs manufactured to B.S.546 and to connect each end of the ring circuit to a separate 15-amp fuseway on a local distribution board. This arrangement contravenes instructions set out in the 12th Edition of the I.E.E. Regulations in so far that, firstly, the switch socket outlets should have been of 13-amp rating and fitted with fuse plugs in accordance with B.S.1363, and secondly, the two ends of the ring circuit should have been connected to one 30-amp fuseway of the distribution circuit. The circuit arrangement given in the I.E.E. Regulations is, of course, far preferable since installation costs are reduced and, as most electricians know, fuses in parallel are generally a nuisance. Again, the danger of the circuit being assumed "dead" whereas a feed through the second parallel fuse, if not withdrawn, may lead to an accident.

Advantages and Savings

The advantages and savings in installation costs in adopting the ring circuit should be clearly understood by all concerned with installation work.

Ring circuits are classified for two conditions: (*a*) One for residential premises not exceeding a floor area of 1,000 sq ft, and (*b*) one for residential and other premises where the floor area exceeds 1,000 sq ft.

In the first condition (*a*) to a ring circuit comprising 2×7/·029 conductors, any number of 13-amp socket outlets may be connected. Spurs comprising 2×7/·029 conductors may also be connected to the ring circuit, but not more than two 13-amp socket outlets may be connected to each spur. Further, the total number of 13-amp socket outlets connected to spurs from the ring circuit must not exceed the number of 13-amp socket outlets connected directly in the ring circuit. For example, if there are 10 socket outlets connected directly in the ring circuit, then not more than a further 10 socket outlets can be served by spurs from the ring circuit.

Under the second condition (*b*) the number of 13-amp socket outlets is limited to 10 for a ring circuit which, of course, means where more than 10 13-amp socket outlets are required further ring circuits must be installed. The same conditions and limitations for installing spurs from the ring circuit and the number of 13-amp sockets connected to each ring circuit and spurs also apply. For example, if six 13-amp sockets are connected directly in the ring circuit, since a total number of 10 13-amp sockets can only be connected to this ring circuit and its spurs, it follows that the maximum number of 13-amp sockets that can be connected to spurs off this ring circuit will be four.

Fixed Appliances

Where for one reason or another fixed appliances are to be connected to the ring circuit under both of the above conditions (*a*) and (*b*) this is permitted subject to fuses of the appropriate current rating being mounted adjacent to the fixed appliances. Further, the total current passed by the appliance or appliances connected to each ring circuit must not exceed 15 amps. Again, under condition (*b*) every fixed appliance connected to a ring circuit counts as equal to a socket outlet. Therefore, the total number of socket outlets plus the fixed appliances connected must not exceed 10 for each ring circuit and its associated spurs for condition (*b*).

M.I.C.C.

General points to note are where mineral insulated cables are used the cross sectional area of the conductors can be as low as ·003 sq ins and the 13-amp sockets may incorporate a switch. Whilst all sockets on a ring circuit can be "alive" it does not necessarily follow that the ring circuit is complete. To ensure continuity of the ring circuit it is necessary when testing to open the circuit at a convenient point, i.e. the distribution unit and test through the conductors to ensure there is not a break at connection points in the circuit.

Thirteen-amp sockets and switch sockets are not in general suitable for connection to d.c. services.

Convention Diary

FINE weather, the capaciousness of the Dome as a meeting place, and, above all, continued complaints against capital restrictions : these will be the lasting memories of the 1951 British Electrical Power Convention.

Bright sunshine was already providing a cheerful background when Monday's usual business of registration and the renewal of old friendships began. For British Electricity representatives (357 out of the total of 842 delegates and visitors, excluding the ladies) there was a private meeting, closely guarded to prevent unauthorised access. It was on this occasion that Lord Citrine, in a speech noted in our last issue, fired the first shot in the Convention's cannonade against the planners.

More sociable activities on this first day were the opening of the exhibition and the mayoral reception in the ornate Royal Pavilion. The first of these events attracted a large gathering at the Floral Hall, where rumours of restricted space for exhibitors were found justified. This was not entirely a disadvantage, and there were some favourable comments from visitors on the show's welcome compactness, but it must be admitted that more stands with more space apiece might have added to the usefulness of the exhibition. Undoubtedly, E.D.A. staff had completed a splendid job in unfavourable conditions to make the hall as attractive as all admitted it to be.

Tuesday

Work in earnest for most delegates began on Tuesday, and there was a good gathering in the circular auditorium to hear Sir Henry Self deliver his presidential address, after the Mayor of Brighton had accorded the delegates a formal civic welcome. Sir Henry's close analysis of facts and figures gave delegates plenty to think about as they adjourned for lunch. This was in contrast to Mr. Humphrey's entertaining but very general survey of electronics in the afternoon. A fine collection of apparatus had been assembled for this, but it must be confessed that even with Mr. Humphrey's skill in lecturing, the ladies who were "specially invited" found the jargon rather too much.

President's Reception

Tuesday evening, by tradition, was set down for the President's reception. For this function, the elegance of the Pavilion was abandoned for the greater spaciousness of the nearby Corn Exchange. Here, some modern relief to earlier functionalism was given by E.D.A.'s attractive lighting improvisations. Five 12 ft long "chandeliers" housed vertically mounted colour-matching fluorescent lamps, while auxiliary tungsten lighting and some coloured fluorescent tubes added warmth to the scene.

Wednesday was selected this year for the reading of the principal convention papers, evaluations by Mr. H. H. Mullens (Chairman, N.E.E.B.) and Mr. N. Elliott (S.E.E.B.) of electricity considered as a national asset. These two papers were summarised in these columns last week, and only the discussion remains to be dealt with here. It has to be noted that this

was severely restricted by shortage of available time.

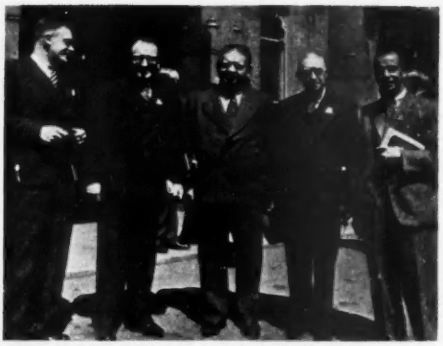
First speaker was Mr. E. R. Wilkinson (Commercial Manager, B.E.A.) who commented on the common interest in railway electrification displayed by both authors, and by Sir Henry Self in his presidential address. Extending the figures they had quoted, he suggested that the £30 to £35 million saving every year which would result from railway electrification, would cover the capital charges on an expenditure of some £300 million.

The case of railway electrification was an outstanding instance of what was happening

Mr. Nimmo (S.E.B.) and Dr. Schmidt with Dame Caroline Haslett, Miss Norvick and Miss Lockhart of the E.A.W.

throughout the national economy : an unhappy competition between restrictions on capital expenditure and the attraction of such expenditure as a means of lowering running costs. One of the justifications of nationalisation schemes had been that they would enable capital to be raised when necessary : now the coal, transport and electricity authorities were appealing for capital expenditure without success.

Turning next to Mr. Mullen's remarks on private generation, Mr. Wilkinson suggested that it was only when surplus steam was available that private generating plant was justified and became an economical asset. He believed that the supply industry should be willing to provide the plant needed to give electricity and process steam, and that it should also be the duty of the industry to help the industrialist decide what were the optimum conditions of waste heat generation from the national viewpoint.

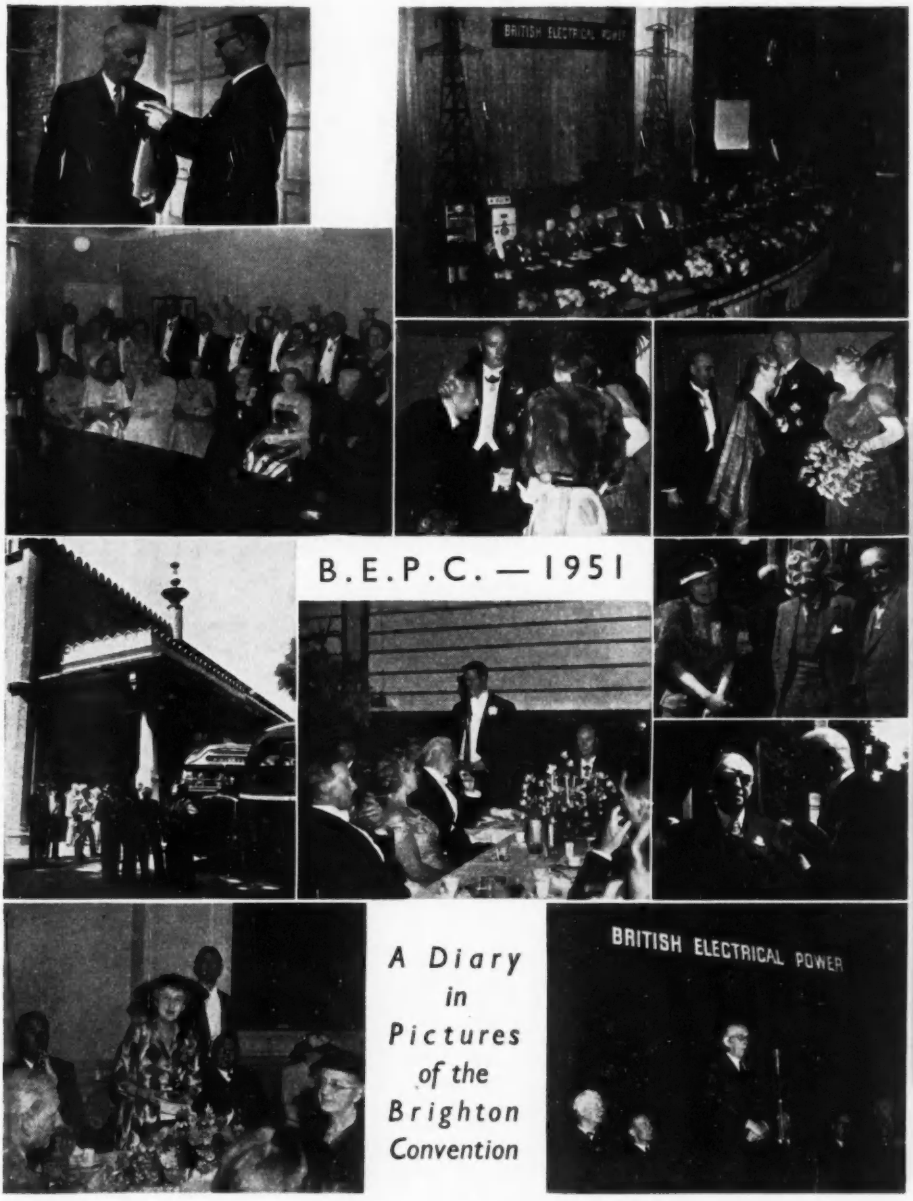


Alderman Lewis, chairman of the Midland Board, and Sir Joseph Hallsworth of the N.W.E.B. are seen with other delegates

Mr. J. Eccles (M. and N.W.E.B) emphasised again the degree in which more horse-power per worker could reduce the price of goods and increase productivity. Planning could be of a dictatorial kind or a co-operative kind : the industry was ready to discuss its problems if the planners were ready to listen. The Central Authority could certainly help themselves in present difficulties, for instance, by organising site work as a military operation, while area boards could cut frills from various projects, perhaps by accepting a lower standard of supply continuity. The Convention would have failed in its purpose if there were simply talk of such matters, with no action taken when the delegates reached home.

Some change in approach came from Mr. Hazell, speaking as a manufacturer of heating appliances. He spoke of the economical possibilities of solid fuel combined with electric heat-

Mr. Herod, principal guest, and Sir Henry Self with their ladies and with Lady Citrine to complete the group



Between Monday's registration and Mayoral reception, shown top left, and final event of next year's president, (Mr. P. V. Hunter) accepting office, bottom right, delegates at Brighton had a full time. On Tuesday there was a civic welcome in the conference hall (top right) and, in the evening, the presidential reception (just below), at which we noted Dr. and Mrs. Dunsheath and Mr. and Mrs. Eccles being received. For the start of Wednesday's trips, delegates assembled at the Dome, where some are pictured discussing weather prospects. Below them is seen Lady Swaythling at Thursday's E.A.W. luncheon, while to the right Mr. Herod addresses the gathering at the annual dinner. Our other photographs show Sir Vincent and Lady Ferranti and T. G. N. Haldane above, and Sir William Walker, chatting to Sir Joseph Hallsworth

Sir Henry chats with Mr. Luffingham, P.R.O. to the Authority and Mr. V. Dale, director of E.D.A.

ing, and specially recommended the thermostatically controlled oil-filled radiator. Mr. R. H. Rawll (L.E.B.), who followed, raised the question of the rating of electronic devices, and pleaded for some standard system, so that tariff difficulties which were common in the early days of electric welding should not recur.

Dr. S. Whitehead (E.R.A.) spoke of the value of interaction between users in popularising new ideas. In matters of electrical supply, particularly of methods of using power, this interaction was difficult to induce without risking the charge of prying into other people's affairs.

This view of the Corn Exchange shows E.D.A's lighting arrangements to advantage

Mr. Irens (S.W.E.B.) welcomed the comments on back-pressure sets, being a great believer in the useful application of potentially waste power. He suggested that the fuel saving resulting was of the order 1 lb coal/kWh. He was about to develop the theme of encouraging industry to take up private generation when Sir Henry Self brought the discussion to a close. A hope was expressed that time could be found for further contribution from Mr. Irens on Thursday, but, in the event, he did not speak again at the public sessions of the Convention.

A pleasant occasion was provided on Wednesday by a complimentary luncheon to the members who were attending a meeting of the C.I.G.R.E. Council in Brighton and who also took part in the Convention. Mr. P. V. Hunter was in the chair and welcomed the overseas members of the Council. He mentioned that in order that there should be representation of the B.E.A. on the C.I.G.R.E. Council, Mr. H. Nimmo had been elected as an additional member. Dr. R. A. Schmidt replied thanking the host. This is the first time that the C.I.G.R.E. Council have met in this country and they were made most welcome.

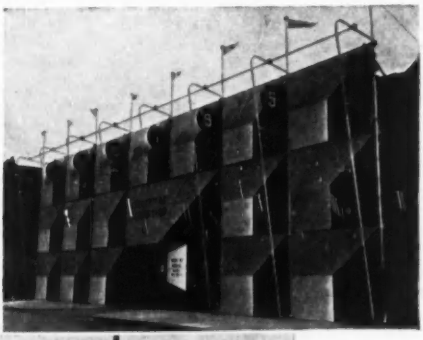
Delegates split up into three groups for visits in the afternoon. In the technical field objectives were Brighton B power station and the Southern Cross 132 kV grid substation, both of which are in the constructional stage. Glorious weather added to the enjoyment of these visits, in which special care was taken to interest the ladies, and also to the sea trip to Beachy Head which was essayed by the third party of delegates.

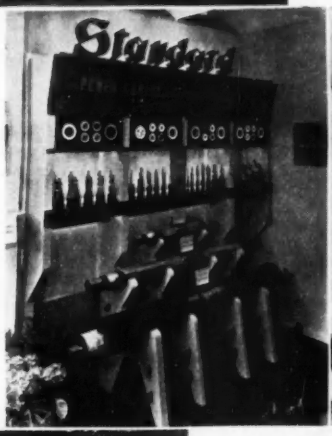
Thursday

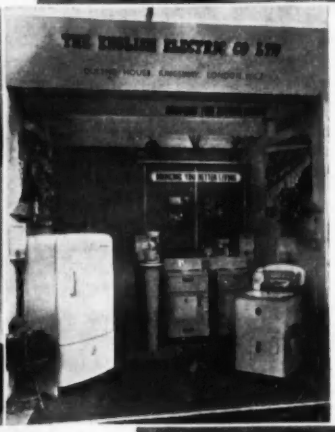
Immediate worries of the supply industry were left behind in Thursday morning's paper, which is summarised on page 1109.

It was followed by the highlight of the Convention for the ladies, the E.A.W. lunch which attracted the usual distinguished gathering. Miss Violet Markham proposed the toast of "Electricity and the Festival Year." She referred largely to Paxton's work in connection with the Crystal Palace and pointed out that as long ago as 1849 he suggested the use of electric light for stimulating plant growth. She pleaded for an increasing number of small and inexpensive appliances to ease the work of the housewife : she was convinced that the electrical industry could provide such labour-saving equipment if it set its mind to do so.

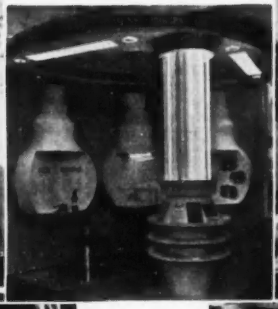
Sir Henry Self replied, sympathising with the ladies. They had been promised an abundance of electricity tomorrow but not today. They

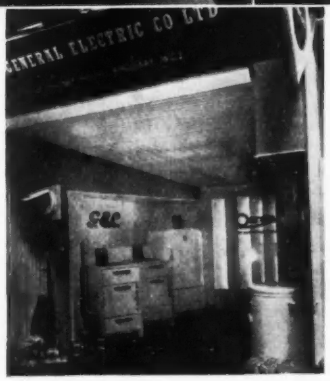






CONVENTION
ELECTRICAL
EXHIBITION





had always made life possible under the difficulties of the past, and they must, in future, contrive to maintain the household. They have carried on so far and must continue to carry on with a shortage of electricity. There was a real need to contrive to use electricity when industry does not need it. The toast of the Guests was proposed by the President, the Dowager Lady Swaythling, in her inimitable style, and Sir Montague Hughman replied.

In the afternoon the ladies were again entertained, this time at a tea to meet Lady Self, during which a mannequin parade was organised for their attention. And so to the evening, where, in the Corn Exchange once again, Sir Henry Self presided over some 800 delegates and guests and their ladies at the third annual dinner of the Convention.

Principal guest this year was Mr. W. R. Herod, co-ordinator of the North Atlantic Treaty Defence Production Board, and he received a warm reception when he rose to propose the toast "The Electrical Industry." Introducing his address with a review of the differences between the North Atlantic Treaty Powers and the Soviet *bloc*, Mr. Herod went on to compare the productive potentialities of the two groups. The aggregate resources available were, he said, in favour of the N.A.T.O. countries. Disunity, division or failure to pull together could limit the realisation of these potentialities, and individual national characteristics presented some handicaps in the dovetailing of defence production efforts on an international scale.

N.A.T.O. defence production board had the mission of analysing, studying and recommending action in the broad armament production field; industrial planning within this field was hence within the purview of the board. It was not generally realised that increased aggregate production was the outcome of an increased devotion of energy to productive purposes. An increase in horsepower, mostly electrical and applied through machines, tools, etc., had enormously increased the effectiveness of the worker in the United States. Because of this ability to "chew up" raw materials faster, and of an increase in real demand, together with an accentuated fear of shortages, shortages had occurred without any decrease in supply.

If N.A.T.O. countries could continue to increase productivity per head over the next few years at half the rate prevailing during the past few years, they could, after a readjustment period of perhaps three years, carry on the present rearmament programme, short of war, together with a progressive increase in the level of living. During the readjustment period, controls would be necessary, particularly in allocations of materials. Under today's conditions, emphasis had to be placed on the expansion of electric power for production, rather than for further consumption in the home.

To this speech Sir Henry made a witty but properly appreciative reply, stressing his belief that Mr. Herod's presence symbolised the link between Great Britain and the United States that had potentially so much to offer for the good of the world. He asked Mr. Herod to take back with him a message of the electrical industry's determination to play its full part in such co-operation.

After Sir Henry came Sir Vincent Z. de Ferranti, with a toast to the guests which was responded to by Mr. H. Neal, M.P., Parliamentary Secretary to the Ministry of Fuel and Power, and by Alderman E. Simms, the Mayor of Brighton. The diners then adjourned to the Dome, this time for play in the form of a varied selection of cabaret turns.

Friday

On this final day of the Convention, the weather changed, and there were grey skies as delegates assembled for the last time in the portico of the Dome. Dame Caroline Haslett's paper, "Electricity—a Factor in Social Progress," which was presented on behalf of the E. A. W. is summarised elsewhere in this issue (page 1111). Once again, the discussion on it had to be curtailed, and the audience was freshly convened as an annual general meeting.

The essential facts of this A.G.M. are readily recorded—Hunter and Bournemouth. Sir Henry's announcement that Mr. P. V. Hunter had been nominated by the Convention Council as next year's president was received with warm applause, and there was some witty by-play in the following speeches of Sir Henry and of Mr. Hunter. Also popular was the nomination of Sir John Hacking as vice-president of the Convention. This is a new position, and one which will remove from convention pastimes the pleasant game of guessing next year's president.

Delegates from the south learned with some pleasure that Bournemouth had been selected as the 1952 Convention town : relatively short train journeys have advantages over long trips north.

And so to the final votes of thanks, a last look at the exhibition and a quiet conclusion to the third convention in a nationalised guise. Next year there is to be financial independence, and it will be interesting to try to spot any changes this brings. Whatever they are, Brighton will remain a pleasant, if technically rather dim, memory.

Mr. Edwin Batt, Director and Secretary of The British Refrigeration Association, reviews the position of the industry today, emphasising technical training and sales service backing for first class products

Refrigeration Survey

TODAY the refrigeration industry in Britain employs some 12,000 workers spread over nearly 200 firms, and during 1950 equipment was exported to 126 individual overseas territories. These striking figures were mentioned by Mr. E. G. BATT (British Refrigeration Association) on Thursday, when he presented to delegates his paper, "A Survey of the Refrigeration Industry." He went on to divide the products of the industry into three classes—domestic, commercial and industrial, the first section dealing with units of up to 12 cu ft capacity, and the last the very heavy type of cold-storage room.

Domestic

Simplification has been the keynote of recent advances in domestic refrigerator design, both in appearance and operation. The use of metals and plastics in construction has increased life, particularly in tropical use, and bonded glass fibre insulation has similar advantages. Special metal forming tools and enamelling techniques have made high-grade construction reasonably inexpensive, and Mr. Batt described in some detail the techniques involved.

Modern trends are towards using a hermetically sealed type of refrigerator system, with electric motor and compressor forming an integral part, which is mounted inside a hermetically sealed casing. Possibility of refrigerant leakage is materially reduced, an important factor contributing towards an expected life of ten to 15 years. To secure this life, assembly tolerances of 0·002 in. are maintained and some bearings are surface finished to an average flatness of 5 micro inches. Simplicity and accuracy are again involved in the expansion device, a 15 ft long and 0·03 in. dia. tube having a very superior internal finish.

In the course of construction the refrigeration unit is subjected to about 1,000 inspection functions, with particular attention to gas tightness, pumping efficiency, final performance and noise. The final test for gas tightness aims at ensuring a standard such that any leak is detected which would cause trouble in 20 years or less.

Commercial and Industrial

Standard sizes for commercial service cabinets are 13, 15, 25, 40, 60, 80 and 100 cu ft, with a maximum height of 6 ft, and with about 2 in. of insulation up to 25 cu ft and 3 in. of cork (or its equivalent) in larger sizes. Cold rooms from 100 cu ft to 500 cu ft are generally factory made in sections, and erected on site; above this size much depends on such external factors as the degree of permanence of the site. A rapidly developing additional type of refrigerating equipment is that suitable for display and selling purposes. Stress by the Ministry of Health and other authorities on the necessity for clean foods is rapidly forcing retailers to invest in this type of display.

For all modern types of refrigerator, automatic controls are necessary, and in this country the manufacture of the necessary type of equipment commenced in 1928. Generally speaking, two types can be distinguished: safety devices, such as high pressure, high temperature and vacuum cut-outs, and regulators to enable the refrigerator to maintain a predetermined set of conditions.

The simplest form of device is pressure-operated, usually involving a metallic bellows or a Bourdon tube. Such regulators are more suitable for domestic than for commercial

refrigerators with varying load conditions, and for these latter thermostatically operated devices are more common. Most use a bellows-operated switch mechanism connected by a length of capillary tube to a sensitive feeler. Variations in feeler temperature cause variations in pressure in the thermal system, and thus expand or contract the bellows. In domestic refrigerators, the thermostat controls the temperature of the evaporator, but in commercial units other than ice-making plant it responds to the air temperature.

Finally, in his list of controls Mr. Batt dealt with the thermostatic expansion valve, consisting of a pressure-operated valve with a pressure-sensitive element. It is ideal for most applications where varying load conditions have to be encountered.

Refrigerants

In the early days of mechanical refrigeration there were few readily obtainable compounds suitable for use as refrigerants, and ammonia or carbon dioxide were common. Automatic machinery of the smaller type led to the need for compounds involving lower pressures, and sulphur dioxide and, later, methyl chloride came into use. Later it was found by physical chemists that almost any kind of refrigerant could be synthesised by substituting chlorine and/or fluorine atoms for hydrogen atoms in the hydrocarbons and ethane, and the "Freon" series was evolved.

Factors influencing the choice of a refrigerant are boiling temperature and pressure, freezing temperature, ratio of specific heats, critical temperature, latent heat, specific heat of vapour, density, thermal conductivity, stability at high temperature, dielectric strength, toxicity and flammability. In the case of small refrigerators, the trend is in the direction of non-toxicity, non-flammability and stability, even at the expense of other characteristics. From 20 h.p. upwards, ammonia still continues to be used, though in certain circumstances "Freon" 12 or "Arcton" 6 is replacing it for ratings as high as 200 h.p.

Service and Training

For an increase in sales volume, it is essential that prospective customers have confidence in the ability of the manufacturer to keep his equipment in good running order. This means that a servicing organisation has to be set up, and brings in the problem of the servicing engineer. Manufacturers have to assist in the training of such engineers, and such training has been organised with a notable degree of success.

Training for domestic service engineers has become relatively simple with the advent of the hermetically sealed system, since, except in the case of simple electrical faults, standard procedure is to replace the faulty unit and return it to the factory. For the commercial service engineer, however, three-week courses are organised, teaching the elementary fundamental principles of refrigeration, together with the practical applications. In the field such engineers must work under close day-to-day administrative control if maximum efficiency is to be achieved.

At a somewhat higher level than the service engineer there is a shortage of properly qualified technical personnel. One trouble encountered is that the engineering schools and the universities only lightly touch upon the science of refrigeration in most of their courses. Some improvement is expected as a result of the establishment of the National College for Heating, Ventilating, Refrigeration and Fan Engineering at the Borough Polytechnic in London.

The Cryostat

In the final section of his paper, Mr. Batt discussed many applications of refrigeration: space can be found here for one only. It is a 15 cu ft super deep-freezer in operation at the Massachusetts Institute of Technology. Technically called a cryostat, it cools its contents to —452° F, operating by compressing, regeneratively cooling and then expanding helium until a portion of the gas turns into a liquid 7½° above absolute zero. The 2 ft 6 in. diameter by 3 ft deep cylindrical working space it provides should facilitate study on a larger scale of many of the strange phenomena that occur near absolute zero.

DISCUSSION

There were two main speakers in the discussion on Mr. Batt's paper. First came Mr. E. G. Rowledge (B.R.A.), who emphasised the importance of well trained men in the field, since an increasing amount of application engineering would become the responsibility of outside representatives. Mr. K. J. R. Cocke (B.R.A.), who followed, had some interesting comments to make on abstracting moisture from motor windings in hermetically sealed refrigeration units. He also raised more queries about hire-purchase policy. The other speakers were Mr. W. N. C. Clinch (E. Div.) and Dr. E. H. Rayner (E.R.A.), the former speaking on absorption-type refrigerators and the latter on an early discovery that aided construction technique. Mr. Batt replied briefly to the discussion.

Dame Caroline Haslett presents the woman's view of advances in the technique of living which electrical power has made possible, and underlines them as the greatest importance to national well being

A Factor in Social Progress

AN analysis of the meaning of "social progress," and some thoughts on it expressed by technical men, occupied the early part of the paper "Electricity—A Factor in Social Progress," which Dame CAROLINE HASLETT, D.B.E., COMP.I.E.E., J.P., read before the Convention on Friday morning. Dame Caroline went on to analyse social progress under a number of headings, and to assess the contribution of electric power in each case.

She took the home first. Here electrical energy replaces human energy, and helps the housewife to win what is otherwise so often a losing battle with dirt and inconvenience. Moreover, it obviates the bad psychological effects of dingy surroundings and poor tools. In this respect it is of interest to note that power used in the U.S.A. corresponds to providing every inhabitant with the equivalent in normal labour of more than 30 servants: in Great Britain the comparable figure is 13 or 14 servants. Probably the "all-electric" housewife saves about 24 hours per week compared with her neighbour less happily equipped. Tests made in laundering are quoted in the paper, together with further examples resulting from cooking economies, from lighting and from the minor conveniences offered by electrical apparatus.

In terms of health and environment electricity contributes improvements in many ways, but notably by making possible a clean atmosphere; 54% of the 2·4m. tons of smoke emitted every year comes from domestic chimneys, against 0·4% from power stations.

In the country, in entertainment and communications and in education, electricity has its effect, and Dame Caroline had something to say on each. She went on to speak particularly of the special needs of our age, instancing the manner in which electricity, with its safe and easily controllable power, is especially adapted to old people's needs.

Design for Living

Space and time problems are the dominant factors in design for living as a framework within which our complex society can fulfil its promise. In terms of living accommodation, electricity can bring light, ventilation, heat and vertical transport that effectively doubles or quadruples a given space. As to time, in addition to its functions as a time-saver in the way already discussed, it makes a given amount of free time more useful, because it is less needed for recovery from preceding mental and physical fatigue.

Electricity as a factor in social progress is something which far transcends the selling of electrical appliances. It is even something more than a contribution towards the emancipation of women. It is a factor in race survival itself. The evidence produced in the paper, said Dame Caroline, is a challenge to all those who may limit this well-being, either the Government by restricting electrical development, or the electrical industry in failing to press forward with new applications.

DISCUSSION

In a short discussion, to which there was not time for Dame Caroline to reply, Mr. R. H. COATES (Southern Div.) considered the importance of education in the use of electricity, Mrs. F. FORREST (S.W.E.B.) dwelt on the importance of the service centre and its staff, and Mr. L. GOSLAND (E.R.A.) sounded a warning note on research difficulties and the cost of improvements.

Problems and Practice

IN ENGINEERING

Motor Earth Relays

TO adequately protect large motors, it is our standard practice to provide overload and earth leakage protection, with current transformers feeding P. and B.-Golds relays. The overload feature is provided by heater coils, which give a time lag, supplied through additional saturation c.t's to prevent burn out of the coils on the occurrence of between-phase faults, and to prevent the re'ay tripping during long starting periods against high inertia loads. The leakage element is, however, directly connected in the residual circuit of the main c.t's and is instantaneous in operation.

The normal starting current of large motors with direct-on starters is about six times normal full-load current, but due to assymetry and the bending of the B-H curve for the iron circuit of the motor, it is generally assumed that the value of the assymetrical current on one phase is many times this value, perhaps 20 or 30 times normal full-load current for a few cycles.

The line c.t's saturate at about 15-20 times full-load current, and hence the c.t. on the line carrying the assymetrical current will have reached saturation, whilst the c.t's on the lines with normal currents will be well below the knee of their characteristic. This results in two c.t's delivering correct currents to their secondary circuit, but the saturated c.t. delivers a false current, thereby giving a false residual current which causes the operation of the earth leakage element.

The trouble could be entirely removed by installing motor starting gear to control the heavy primary currents, or by installing c.t's which would take the heavy current without saturating. However, an easier method of overcoming the trouble is to install a small damping resistor in series with the earth leakage element, and experiments have been conducted using a variable resistor to determine the minimum possible value—so far 10-15 ohms is the lowest value to give stability on starting.

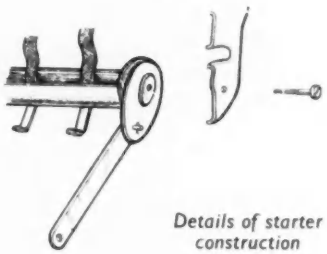
This resistor does not alter the fault setting of the relay, as a c.t. delivers its current through any secondary burden until it saturates. Also, as the motor circuits are totally enclosed in earthed metalwork, any earth fault will be in the order of kiloamperes and operation will be certain.

Alternatively, some manufacturers incorporate a small condenser to damp out the d.c. component, and to bring the assymetrical wave back to a sinusoidal function, but this is only feasible in the case of high-impedance relays and very small currents.

Spill currents may also be caused by third harmonic currents which become additive. Such currents can only flow in the primary conductors if the motor is star connected with earthed neutral, but this is not a normal condition. These third harmonic currents can occur in the secondary circuit, however, if the c.t. iron is saturated due to the distorted wave form.—*I.G.*

Starter Trouble

THE source of trouble was a water pump, direct-coupled to a 45-h.p. 440 V 3-phase 2,850 r.p.m. squirrel cage motor, which would start all right, but ran both hot and noisily. Starting was by means of a hand-operated, oil-immersed, "star-delta" starter. As this pump ran 24 hours per day, with no standby pump, and was used for de-watering a mine, it was an urgent matter to repair it.



Details of starter construction

When I arrived in the pump-chamber, the motor was switched off and the water rising much too rapidly. I switched on; pushed the starting handle into "start," and, as the motor ran up to "star" speed, listened hard. Sizzling fuses; arcing starter contacts; grumbling motor bearings; I expected any of them. I held the handle where it was for a minute. No steam emanated from the pump glands. Situation normal! Up with the handle and smartly into "run" (*vide* the text-books).

For a moment the speed climbed, then dropped slightly, the motor setting up a "single-phase" growl. I switched off, and removed the oil tank. Sticking my head under the works, I glanced along the triple row of contacts, and then nearly put the tank back prematurely, as everything appeared to be in order. Then I noticed that the right-hand end rotor pivot pin (a 2BA screw) was not quite home. Testing by hand showed that the rotor was free to move, within limits, at that end.

Closer examination now revealed that when the pivot pin had unscrewed itself sufficiently, the rotor was allowed to drop, but, due to the rimmed form of the alloy pedestal, could only drop $\frac{1}{8}$ in. approx. As the rotor is rocked by means of linkage inside the front of the starter, the rotor was forced backwards and made contact satisfactorily in the star position, but when *pulled* forwards into delta, the end pair of contacts remained $\frac{1}{16}$ in. apart, thus causing the "single phasing." A star washer under the pivot screw head cleared the fault.—"*Hamfist*."

Slot Insulation

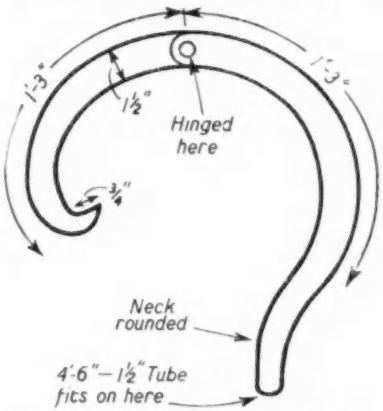
DURING routine inspection of electrical machines measurements of insulation resistance are often made, but when good values are obtained between conductors and frame, such values should not be acceptable evidence that all the insulation is in sound condition. It is impossible to measure, for example, the insulation resistance between the top and bottom conductors in a d.c. armature slot, and when it is realised that the voltage between such conductors is the full terminal voltage of the machine, and the consequences of a failure of this interlayer insulation, one should not be misled into putting too much trust in insulation resistance measurements to earth.

The mistake is often made, especially by repair firms, to reinforce the slot insulation of a d.c. machine while omitting to ensure that the insulation between top and bottom conductor layers in a slot is at least equally as reliable as the slot troughing. Such a case occurred in a local works recently, where, when repairing an armature following failure between top and bottom layers, it was found that when previously rewound the slot insulation included a trough of mica, while the insulation separating the top and bottom conductor layers consisted of one strip of leatheroid only.

When a d.c. motor is supplied from the outers of a three-wire supply with the mid-wire earthed, the voltage between top and bottom conductors in each slot is twice the voltage between the conductors and the armature core. In this case the importance of the interlayer insulation compared with that of the slot troughing is clear.—*T. S. P.*

Tool for Pole Turning

WITH reference to the above article by Mr. Pearson in "Problems and Practice" in your issue of April 12, I would like to give details of a similar device successfully used for



pole turning in this district. The main difference in this construction is that the claw iron is hinged itself and thus no "stops" are required. The sketch given above shows the design of the tool. If a small diameter pole is encountered, this can easily be overcome by packing. An alternative and simple method that can be used is by means of a looped rope round the pole secured to a baulk.—*High Tension.*

Locking Small Nuts

SMALL nuts on electrical connections are always liable to slackening. Where it is not possible or desirable to use the usual locking devices, small nuts can be locked by drilling an $\frac{1}{8}$-in. hole in one of the flats 75% of the way through to the threads. Then screw the nut in tight; then by means of a pair of pliers with a projection on one face which will reach to the bottom of the hole, force them hard on the nut. This will force the threads of the nut at the point opposite the hole into the threads of the screw locking the connection.—*W. E. W.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.

overseas news

Plant for Malta

The first machinery for the new power station for Malta arrived at the island recently. It comprised two turbo-alternator sets made by the Westinghouse Co., of U.S.A.; their purchase being arranged with Marshall Aid funds, as we have already reported. The sets, each of 5,000 kW, are destined for the new underground generating station, now being constructed at Jesuits Hill, Marsa, and which is expected to go into commercial operation in just over a year's time. Other equipment for the new station is expected shortly; this includes another similar turbo-alternator set.

Brisbane Railways

The first heavy rails for the electrification of Brisbane railways are expected to be laid next month. The project is not expected to be completed before 1959. At present the heaviest rail used in Queensland weighs 82 lb a yard, but for electric trains, having greater acceleration, rails of 94 lb a yard are being used. These are being obtained from England.

Officer for Rural Electricity

The New South Wales Department of Agriculture now has a rural electricity officer attached to it. He is Mr. J. R. Lloyd, who recently joined the N.S.W. Electricity Authority after 19 years as electrical engineer with the Coonabarabran Municipal Council. Making this announcement a few days ago, the Minister for Agriculture, Mr. Graham, said it had been his desire for some years to have an officer in his Department who would be qualified to advise and assist farmers in the use of electricity, both for light and power, on their farms. Mr. Lloyd's appointment would fill this gap in the Department s services to primary producers.

King Island Supply

The Hydro Electric Commission of Tasmania hopes to have a diesel-driven generating plant in operation at Currie, King Island, within the next three or four months, we learn.

W.A. Acquisition

Acquisition by the State Electricity Commission of Western Australia of the electricity undertakings of six local authorities in the metropolitan area has been announced in the "Government Gazette". The authorities involved are the Claremont, Guildford and Subiaco Municipalities and the Bassendean, Nedlands and South Perth road boards.

Inauguration

To-day, June 28, sees the formal opening of the Whatshan hydro-electric development of the British Columbia Power Commission. The project, with an initial capacity of 33,000 h.p., will serve approximately 14,000 consumers in more than a score of rapidly growing districts.

Manitoba Analysis

A complete analysis of the electric power supply and demand situation in the province has been ordered by the Manitoba Hydro-Electric Board. Announcing the board's decision, Mr. D. M. Stephens, chairman, said the last published information on anticipation of Manitoba's power requirements was contained in the Hogg report, prepared early in 1948. The new report will analyse the province's probable power requirements over the next three to five years in order to make adequate plans for development of future power sources. Information is being requested from the Winnipeg Electric Co., the City Hydro, and the Manitoba Power Commission as a basis for the forecasts. It is expected that it will take about six weeks to prepare the report.

Another Plan

The Manitoba Hydro Electric Board is also studying the feasibility of developing McArthur Falls on the Winnipeg River, the only undeveloped site in the Manitoba section of its watershed. Capacity of the development, however, might not be more than 50,000 h.p., and, being a low head project, the cost would be relatively high, probably $350 to $400 per h.p. at present costs. The Board is also to open negotiations with Ontario on the possibility of developing Boundary Falls on the Winnipeg River, a site which is on the Ontario side of the Manitoba-Ontario boundary.

Plan for Newfoundland

For Newfoundland a bright future has been forecast, although there is much hard work ahead. Already investigations have been made of possible industrial development and plans are being drawn up for large-scale extensions. Even in regard to water-power, Newfoundland's natural resources have been somewhat neglected, it is reported, although the Province has no known commercial coal deposits. So far it has been left to outside concerns to carry through any development. One of the best water power sources of Labrador—Muskrat Falls—was allotted to a

company 50 years ago on a 99-year lease for an annual rental of $30. Last year the Power Corporation of Canada began an investigation of the power potential of five rivers on the south coast. This programme continues this year—cost $150,000. When it is completed it is hoped there will be sufficient power available to run an industrial site in Bay d'Espoir on the south coast.

A Danish Scheme

A scheme for the complete electrification of the Danish State Railways has been prepared by Dr. P. H. Bendtsen. The main proposal covers about 700 miles of track. Cost of the scheme would be about Kr. 255,000,000. Dr. Bendtsen states that in his view efficiency of the railways would increase to 15% as compared with 5% for steam locomotives with a corresponding annual saving of Kr. 40,000,000 in fuel costs. The electric power, according to his plans, could be produced by a modern thermal plant requiring only low-grade fuel which would otherwise be useless for railway operational purposes.

Power Plan

Although they agreed some months ago to the application of Coleberg Municipal Council (Cape Province, South Africa), for a loan of £52,000 for the erection of a new power station, the local ratepayers have now turned down a proposal to borrow a further £25,000 for that purpose. It was found that the original amount was far too small, and the present machines are in a precarious condition, it is stated. Mr. Conradie, the Council's technical adviser, stated that Escom would only consider a steam power station for Colesberg; he pointed out that the matter had been laid before the Administrator who had supported Escom. The discussion became heated once or twice and the application was finally turned down by 19-15 votes. Those ratepayers who are in favour of the scheme, have asked for a poll.

Kafue or Kariba?

The capacity of the proposed Kafue Gorge hydro-electric scheme might well be greater than was thought, and the cost per kilowatt perhaps less than at the proposed Kariba Gorge scheme, declared Mr. R. A. Nicholson, Economic Secretary, in the Northern Rhodesia Legislative Council, earlier this month. The Government had now sufficient information from an expert, Brigadier C. G. Mawes, to justify it in engaging a firm of consulting engineers to prepare a proper engineering project and undertake surveys, he said. The Government had contributed half the cost of the Hydro-Electric Commission which had studied the possibilities of both the Kariba and Kafue schemes, but four-fifths of the expenditure had so far gone on investigations on the Kariba scheme. He considered it was now time that the attentions of the Commission should be switched to the Kafue Gorge hydro-electric scheme.

Grid for Algeria

As part of a large grant from Marshall Aid counter-point funds to be spent on new developments in French overseas territories, over £1,500,000 is to be expended on the establishment of an electricity grid system in Algeria, it is reported.

Congo Development

A loan of $15½ million within the framework of the Marshall Plan has been granted to the Belgian Congo, to finance the import of machinery and equipment for various public works. These include the construction of three new hydro-electric stations, (*a*) at Zongo, on the Inkisi River, 56 miles from Leopoldville, (*b*) on the Tshopo River, 3 miles from Stanleyville, and (*c*) at Albertville. In the first named station it is planned to install two 10,500 kW sets. At Stanleyville there will be two 4,100 kW units initially.

Vacuum Cleaner Market

An acute shortage of vacuum cleaners on the U.S. market, with production probably amounting to only 50% of demand, is predicted for this autumn by the President of the U.S. Vacuum Cleaner Manufacturers' Association, Mr. G. H. Scott. The demand, he admitted, was running far above normal, a fact which he attributed to the number of houses built in recent months; the number of marriages, and to replacement requirements. "In fact, manufacturers have never caught up with the market," he declared.

Iceland Expansion

To buy power plant in Europe, the Government of Iceland has been granted a loan by the International Bank for Reconstruction and Development. The loan is to be in European currencies to the equivalent of £875,000. It will be disbursed partly in sterling, French francs, Danish kroner and Norwegian kroner to cover purchases in the United Kingdom, Sweden, Western Germany, Norway and Denmark. The loan will help finance two hydro-electric projects which will further develop the resources of the Sog and Laxa Rivers. The Sog project will increase the supply of electricity in Reykjavik and the surrounding area, in which are concentrated 40% of Iceland's population and over 80% of its industries. It is estimated that the new installations will meet all demands for power in the area until about 1957. The Lasa project will increase the supply of electricity to an area which includes Akureyri, the second city of Iceland. The expansion planned for this area is expected to meet its power demands until about 1960. The total cost of the projects is estimated at the equivalent of $13 million. The Bank's loan will be used for goods and services obtained in Europe, while American equipment will be financed through E.C.A. to the extent of about $5 million.

PERSONALITIES

IN THE INDUSTRY

The Sloan Electrical Co., Ltd. has nominated **Mr. E. T. Bull** to be manager of their Manchester branch, with effect from July 1, to fill the vacancy caused by the recent death of Mr. H. Baird. Mr. Bull joined the company in Bristol in October, 1925, and became assistant branch manager at Exeter in 1934. He was transferred to Manchester in the same capacity in 1938, in which area he has gained considerable experience in outside sales representation.

Mr. E. T. Bull

Mr. L. G. Burrows has rejoined Crypton Equipment Ltd. as area manager for the Midlands and South Wales. He was with Crypton as West of England representative until three years ago, when he left to take up a position, which he has now relinquished, as equipment representative for Brown Brothers Ltd.

Davey, Paxman and Co. Ltd, have announced new appointments within their organisation as follows: **Mr. W. A. Sycamore,** M.I.N.A., M.I.Mar.E., who assumes the title of Defence Programme Manager, undertakes the co-ordination of the firm's activities and all liaison with the Admiralty and other Government Departments in connection with the national rearmament programme. **Mr. H. V. Stead,** M.Sc., is appointed commercial manager (engines); **Mr. H. P. Brown** becomes assistant commercial manager (engines), and **Mr. J. A. Bennett-Powell,** B.Sc., A.C.G.I., A.M.I.Mech.E., is appointed traction sales manager.

The more independent status being given to the secretariat of the British Electrical Power Convention was confirmed at the council meeting on Friday last. The president for the ensuing year is **Mr. P. V. Hunter,** C.B.E., M.I.E.E., F.Amer.I.E.E., who is prominently known for his work in the cable manufacturing side of the industry—he is now deputy chairman of British Insulated Callender's Cables, Ltd., and chairman of B.I. Callender's Construction Co., Ltd. He is also past-president of the I.E.E. The new vice-chairman of the B.E.P.C. is **Sir John Hacking,** M.I.E.E., A.M.Amer.I.E.E., deputy chairman, operation, to the B.E.A., whose experience with the Supply Industry in this country goes back to 1903. He has also handled various railway electrification schemes abroad, and later supervised, for Merz and McLellan, the construction of the grid in Mid-East and North-East England for the C.E.B., joining that latter organization in 1934 and becoming chief engineer in 1944.

Mr. P. V. Hunter

Sir John Hacking

Other members of the Council, and the organisations they represent are: **Mr. J. R. Beard,** C.B.E., M.Sc. (for Association of Consulting Engineers); **H. Astbury** (B.E.A.I.R.A.); **Col. B. H. Leeson,** O.B.E. (B.E.A.M.A.); **Mr. C. T. Melling,** M.Sc. (E.D.A.); **Lord Citrine, Mr. V. A. Pask, Mr. F. W. Lawton, Mr. L. Howles,** C.B.E., **Mr. W. M. Lapper,** O.B.E., **Ald. W. S. Lewis** and **Mr. S. F. Steward** (B.E.A. and Area Boards); **Mr. E. G. Batt** (British Refrigeration Association); **Sir John Dalton** (C.M.A.); **Mr. W. J. Jones** (E.L.M.A.); **Dame Caroline Haslett,** D.B.E. (E.A.W.); **Major J. L. Drummond** (E.C.A. of Scotland); **Mr. L. C. Penwill** (E.C.A.); **Mr. A. B. Wildsmith** (E.W.F.); **Mr. J. F. Wallace** (Employees' National Committee); **Mr. S. B. Warder** (I.E.E.); a representative

Lady Railing, O.B.E., presenting the Leslie Gamage Jubilee Cup at Witton to Mr. D. Perry, of the G.E.C. Fire Brigade, who have won the one-man drill competition two years running. Sir Harry Railing can be seen on the right with Mr. J. J. Gracie

of N.R.E.I.C., **Mr. W. J. McC. Girvan,** O.B.E. (Electricity undertakings in N. Ireland) and **Mr. K. J. McKillop** (Water Tube Boiler Makers' Association).

Mr. E. Tregenza, managing director of Morganite Resistors, Ltd., has left England on an extensive business trip in the U.S.A., during which he will exchange information on technical and production methods, we understand.

Dame Caroline Haslett, D.B.E., J.P., a member of the British Electricity Authority, will head a delegation from the Authority to the ninth Congress of the International Institute of Management, which is to be held at Brussels from July 5 to 11. The delegation includes **Mr. E. R. Wilkinson,** commercial manager; **Mr. E. Long,** a deputy chief accountant; **Mr. T. Mainprise-King,** an assistant director of establishments; **Mr. E. Butterworth,** secretary of the Merseyside and North Wales Division; and **Mr. R. S. Atkinson,** generation engineer (operation) of the South Eastern Division. Dame Caroline will be attending the Congress in a dual capacity, since she is a member of the Council of the British Institute of Management.

This week, **Mr. H. G. Conde,** chairman of the Electricity Commission of New South Wales, arrived in this country *via* America. He is here for consultations with Government departments and firms who are concerned with generation and transmission plant on order for N.S.W. He is expected to remain a few weeks.

Mr. D. G. Denoon, joint publicity manager, British Insulated Callender's Cables Ltd., and **Mr. C. H. Chaplain,** manager, Publicity Department, the British Thomson-Houston Co. Ltd., have been elected chairman and vice-chairman respectively of the B.E.A.M.A. Publicity Committee for the session 1951-52. Mr. Denoon was chairman of the Committee for the previous session. He has been closely connected with technical publicity to the electrical industry since 1934, when he became publicity manager of the former Callender's Cable and Construction Co. Mr. Chaplain has been with B.T.H. since 1912, and graduated to the post of manager of the Publicity Department in November, 1948 on the retirement of Mr. H. A. Price-Hughes.

Mr. D. G. Denoon

Mr. C. H. Chaplain

After 44 years' service with the British Thomson-Houston Co., **Mr. A. B. Bowater,** personal assistant to Mr. E. T. Hippisley, manager of the Traction Department, is retiring this month. Born in Birmingham, Mr. Bowater received early education at the Bablake School and the Technical College, Coventry. Except for some 3½ years on the staff of the Ministry of Munitions during the first world war, he has been engaged on commercial work in the B.T.H. Traction Department, which he joined in 1909. Amateur theatricals are his principal hobby.

Mr. A. B. Bowater

Mr. H. F. Carpenter, F.C.I.S., F.S.A.A., who, as has already been announced, is relinquishing his appointment as secretary of the B.E.A. upon his retirement in the autumn, has been appointed a member of the Committee which has been set up by the Authority to review the organisational and administrative efficiency of the electricity supply industry as it was established under the Electricity Act, 1947, and matters relating to this subject.

Now in this country is **Mr. R. H. Saunders,** chairman of the Hydro-Electric Power Commission of Ontario. His visit is in connection with the placing of a contract for further generating plant for the Commission, we understand.

OBITUARY

Mr. E. Statham, A.S.A.A., F.R.Econ.S., secretary-accountant of the North Staffordshire sub-area of the Midlands Electricity Board, died on June 14, aged 54.

Mr. H. H. Sieveking, M.Sc.(Eng.), M.Inst.C.E., M.I.E.E., a hydro-electric specialist engineer with the English Electric Co., died on Wednesday, June 20. Apprenticed with the British Thomson-Houston Co., Ltd., he entered their Switchgear Department in 1928, but subsequently left them to study hydro-electric practice with J. M. Voith, in Germany. He served with the Central Electricity Board, in London, from 1933 to 1940, during which time his work covered a diversity of matters, such as comparisons between public supply and private generation for large loads. From 1940 to 1945, he was with James Howden and Co., as chief electrical engineer and technical assistant to the board of directors, and in the latter year he joined the Hydro-Electric Department of the English Electric Co., being largely concerned with projects in Canada, Brazil and India. He also lectured on hydraulic turbine design at the Imperial College of Science and Technology, and earlier this year gave a series of lectures at King's College, London, on "Some Aspects of the Development of Hydro-Electric Power."

Automatic Train Control

Background of the Recent Controversy

SOME prominence has been given recently in the Press to a petition to the Railway Executive from enginemen of the Western Region, British Railways, on safety measures, and this brought an assurance from the Chief Regional Officer that the Region's automatic train control system is still in use. Automatic train control, or A.T.C., involves the transmission of signal indications to the cab of a moving locomotive, accompanied by action on the brakes if necessary. Two systems, both employing electrical apparatus, are in use in this country at present, and the question of standardising for future development has been the subject of study and experiment for some time.

The Western System

Western Region enginemen have a keen interest in this matter because their own railway (formerly the Great Western) has been using A.T.C. for over 40 years, and by the date of nationalisation had equipped about 2,900 route-miles in this way. The action of the G.W.R. apparatus depends on contact between a ramp on the track and a shoe underneath the locomotive. When the associated lineside signal is at "caution," the lifting of the shoe as it rides over the ramp breaks a local battery circuit on the locomotive. This releases a magnetically operated valve, which admits air to the vacuum brake system and sounds a warning siren. Control of the braking is normally taken over by the driver, who brings his train to a standstill at the next signal if it is at "danger."

If the warning (or "distant") signal is at "line clear," however, the ramp is energised, and current picked up by the shoe holds the brake valve closed, in spite of the opening of the local battery circuit on the locomotive. The current also operates a relay which causes the locomotive battery to ring a bell in the cab, the sound of which can sometimes be heard when riding in the leading coach of a Western Region train.

The Hudd System

Shortly before the recent war a different system of A.T.C., known as the Hudd system, was introduced experimentally on the Fenchurch Street to Southend line of the former L.M.S.R., and was brought into regular use on December 1, 1947. The link between track and train, in this case, is magnetic. At the approach to a signal equipped with A.T.C., the locomotive passes over a permanent magnet which deflects the armature of a magnetic receiver. Movement of the armature will cause a brake application to begin after a short delay, if no further control effect takes place, and also starts a siren sounding in the cab. However, an electromagnet is installed on the track some 15 yd further on, and is energised when the signal is at "line clear." This has the effect of restoring the armature, arresting the brake application before it has time to begin, and silencing the siren. Should the signal be at "caution," on the other hand, the electromagnet is not energised, so that the brakes begin to come on and the siren continues sounding until silenced by the driver.

Apart from the fundamental difference in the manner of transmitting signals to the locomotive, both systems have features in common. A failure of the electrical supply in either case will give a "caution" indication, and both provide distinctive audible signals for "caution" and "line clear"—a siren and bell in the G.W.R. system and long or short siren blasts in the Southend line equipment. Both, too, are associated only with warning signals, the responsibility for pulling up at the "stop" signal normally resting with the driver, although the brake application initiated by the apparatus would bring the train to a standstill if he was incapacitated in any way.

Extensive trials of the apparatus used in both systems have been conducted by the Railway Executive in the last year or two, and although no detailed statement has been made regarding them, enough has been said to show that the trend is towards employing a magnetic link in conjunction with certain features of the G.W.R. cab apparatus. One development has been to modify the Hudd type locomotive magnetic receiver so that its armature actuates electrical contacts instead of operating directly on the brake system.

The Great Western apparatus has given long and magnificent service, and the faith of the train crews in its reliability could hardly be better demonstrated than by an apparent reluctance to see it modified. On the other hand, A.T.C. practice overseas, where extensive installations are in use in some countries, generally favours magnetic or inductive methods rather than contact systems.

The BUYER'S *Column*

An Ultrasonic Soldering Bath

THE rapid tinning of small aluminium and aluminium alloy articles is made possible by an Ultrasonic Soldering Bath recently introduced by the Equipment Division of MULLARD LTD., Century House, Shaftesbury Avenue, W.C.2. This unit has been specifically developed for the soldering of small and complex shaped parts which cannot easily be handled by the well-known

Mullard's Ultrasonic Soldering Bath works from the same power unit as the Ultrasonic Soldering Iron

Mullard Ultrasonic Soldering Iron. Included in this category of work are such items as foils, wire and tubes.

The Mullard Soldering Bath should also find extensive use in the making of connections for condenser foils, in the tinning of aluminium galvanometer suspensions, and in the soldering of tubes and sections to anchorings or mountings.

It has been designed to operate from the same power supply unit normally supplied for use in conjunction with the Ultrasonic Soldering Iron. It consists of a small soldering bath $\frac{7}{8}$ in. diameter and $\frac{3}{4}$ in. deep. This is heated by means of a conventional resistance winding, and the molten solder in the bath is agitated ultrasonically by means of a magnetostriction transducer composed of a stack of iron alloy laminations. A control switch on the front of the unit enables the ultrasonic energy to be applied at will.

Ediswan stabilised Power Supply Unit

THE Ediswan stabilised power supply unit is a simple low-priced unit recently introduced by EDISON SWAN ELECTRIC CO. LTD., 155 Charing Cross Road, W.C.2, which effectively meets the demand for a reliable stabilised d.c. supply source.

The unit operates on 200/250 volts 40/100 cycles a.c. supply, and provides two outputs: (1) An adjustable 120/250 V d.c highly stabilised output capable of supplying a load current of 0-50 mA; (2) A 3·15-0-3·15 V 3 amps a.c. unstabilised output. Connection to either output is effected by means of 2BA insulated terminals which also accept 3 mm. resilient plugs. The d.c. output is completely isolated and either the negative or the positive side may be earthed.

An electrostatic screen is fitted between primary and secondary on the transformer. The mains connector is a Bulgin 3-pin Type P73.

The stability of the d.c. output is such that with a mains change of 10 V output change is less than 0·1 V. With a load change of 0-50 mA output, change is again less than 0·1 V. Output is controlled by reference to a neon stabiliser KD60.

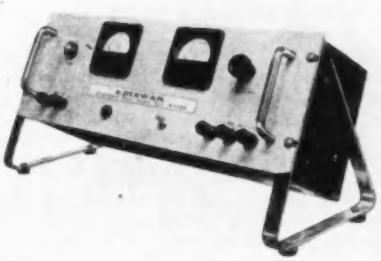
The highly stabilised output can be varied by a potentiometer, and an independent switch is provided to turn off the supply whilst leaving on the output heater voltage. A suitable fuse, pilot light and switch is provided for the whole unit.

The standard model is constructed for 19 in. rack mounting, finished morocoid grey and is supplied without meters. A voltmeter and/or ammeter can be supplied at extra cost. They are the $2\frac{1}{2}$ in. rectangular moving-coil type. The panel is drilled but fitted with a cover plate on the standard model so as to permit the addition of meters by the user at any time. Bench stands (as illustrated) are also available if required.

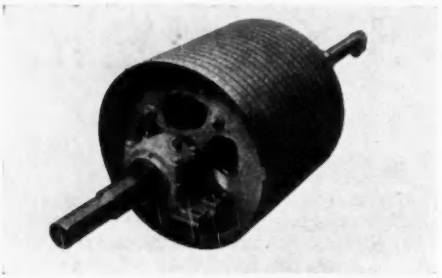
Change in "Osram" Valve Bases

THE GENERAL ELECTRIC CO. LTD., Magnet House, Kingsway, W.C.2, is increasing the diameter of the bases of the following types of Osram valves from 30 millimetres to 34 millimetres: types X61M, W61, DH63, Z63, H63, L63, and W63. Some types have already been changed and others are being changed in the near future, but the increased size should be borne in mind in connection with screening cans.

The new design will eliminate the trouble of bases becoming loose.



Ediswan power plant R1095



Gigantic Magnetic Pulley

AN example of the work undertaken by the RAPID MAGNETTING MACHINE CO. LTD., of Lombard Street, Birmingham 12, is this recently completed electro-magnetic pulley, believed to be the world's largest diameter, which is being shipped to the Belgian Congo.

The equipment is to be installed as the terminal head pulley of a main conveyor system running at half-mile centres and travelling at 256 ft. per minute, handling 700 to 800 tons of tin ore per hour.

Weighing 12 tons, the pulley will extract "tramp iron" in the form of picks, shovels, cutter teeth and short lengths of mine railway line, from the ore prior to crushing; it is mounted on two main and two auxiliary roller bearing plummer blocks, the shaft being 16 ft. long by 8½ in. diameter.

Containing over 3,000 lb. of asbestos insulated copper wire, the magnet consumes 6·25 kW and is rated for continuous duty on 220 volts.

Morphy-Richards Iron Voltages

ON the reopening of the plant of MORPHY RICHARDS LTD., 121 Victoria Street, S.W.1, after the annual works holiday (July 9), the company will be reverting to their pre-war practice of supplying irons having a voltage range of 200/220 volts and 225/250 volts.

TRADE PUBLICATIONS

HELIOCENTRIC SPEED REDUCING GEARS.—Sanderson Brothers and Newbold Ltd. of Allercliffe Steelworks, Sheffield, are makers of these gears in ratios ranging from 20 : 1 to 512.000 : 1 for use with motors from ¼ h.p. to 30 h.p. An interesting brochure describes them.

CIRCUIT-BREAKERS.—An illustrated folder describes the English Electric Air blast circuit-breaker Frame "g". It is available from the English Electric Co., Ltd., whose switchgear department is at Stafford.

CONDUIT FITTINGS AND WIRING ACCESSORIES.—List No. V.G.1 illustrates and gives price quotations for the various "Verglo" fittings and accessories which Stephen Glover and Co., Ltd., of Walsall, manufacture.

FANS.—General fan equipment made by the Sturtevant Engineering Co., Ltd., Southern House, Cannon St., London, E.C.4, is described in publication 2203.

MINIATURE AND EARTH LEAKAGE C.BS.—A new catalogue featuring miniature and earth leakage circuit-breakers and a leaflet illustrating the company's new earth leakage trip are new publications by Chilton Electric Products Ltd., Hungerford, Berkshire.

LIGHTING EQUIPMENT. Siemens Electric Lamps and Supplies, Ltd., 38-39 Upper Thames Street, London E.C.4, have issued a brochure No. 1007 which deals with Festival Floodlighting.

FURNACES.—Shaker hearth furnaces for the needle industry are the subject of a reprint by Birlec Ltd., Erdington, Birmingham.

COOKER CONTROLS.—Leaflets featuring the Simplex 45 amp and 30 amp cooker-control units have been published by Simplex Electric Co., Ltd., 217 Tottenham Court Rd., W.1.

SAFETY SPECTACLES.—Many patterns of industrial safety spectacles are available from The Hadley Company Ltd., Portsmouth Road, Surbiton, Surrey. They are described in a recent brochure.

CONSUMER UNITS.—The recently introduced "Memera" consumers control unit is illustrated in an attractive folder No. 308 available from the Midland Electric Manufacturing Co., Ltd., Tysely, Birmingham 11

FLAMEPROOF GEAR —Plugs and sockets, remote or otherwise controlled air break gate end circuit-breakers bearing the Buxton certificate are featured in recent publications by A. Reyrolle and Co., Ltd., Hebburn-on-Tyne.

LIGHTNING CONDUCTORS.—From W. J. Furse and Co., Ltd., Traffic St., Nottingham, we have received a copy of publication F5 illustrating and describing standard lightning conductor and earthing equipment manufactured and supplied by them.

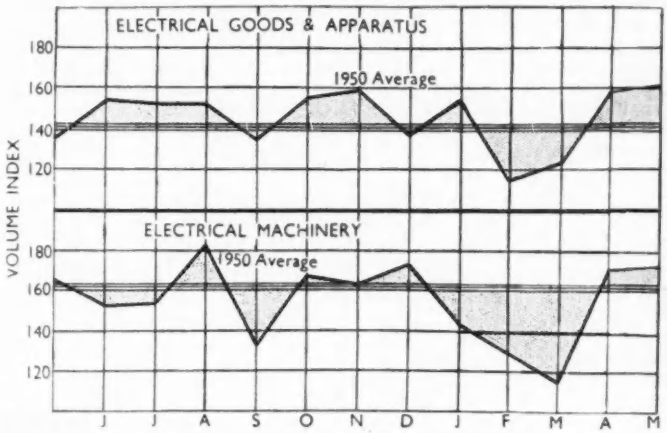
STREET LIGHTING.—Sodium street lighting lanterns are featured in a recent leaflet by Falk Stadelmann and Co., Ltd., 91 Farringdon Road, E.C.1.

SELENIUM RECTIFIERS.—"Sentercel" selenium metal rectifier equipments by Standard Telephones and Cables Ltd., Warwick Road, Boreham Wood, Herts, are described in a new publication F/DR1 issued by the company.

TRANSFORMERS.—Lists No. 1010 and 1530, detailing neon and power transformers, are available for incorporation in the catalogue issued by Foster Transformers and Switchgear Ltd., South Wimbledon, S.W.19.

STROBOSCOPIC EQUIPMENT.—Issued by the Magna Jobson Research Centre, 47 Barnhorn Road, Little Common, Bexhill, Sussex, is a booklet entitled "Some Notes on the Stroboscope," with particular reference to the Ashdown rotoscope. It surveys the use of this instrument.

EXPORTS AND IMPORTS



EXPORT VOLUME INDEX

The notable April increases in the export figures for the electrical industry were well maintained in May, when yet another new high figure was reached for electrical goods and apparatus, with a total export value of £9,483,946. Allowing for the decreased value of the pound and for other factors, this is equivalent to 161% of the 1947 value, and is a new record.

Electrical machinery figures, at £4,185,658, are about the same as for April, and due to the different distribution amongst the various classifications of machinery the index figure based on 1947 volume is actually higher than for April, reaching 171.

EXPORTS by the Electrical Industry last month reached another record, with a total value of £13,364,674, an increase of £180,939 on the figure for April. It is likely, however, that due to the rise in costs of materials and labour, the actual quantity has increased but little. Compared with the month of April, last month's figures showed the largest increases in respect of wireless apparatus and electric cooking and heating appliances. Flat irons alone amounted to £87,521 in value. In addition to the data given below, complete electric washing machines totalling £529,230 in value were sent abroad (compared with £340,767 in the same month of 1950), while corresponding figures for portable electric tools were £94,861 and £85,587 respectively.

Description	Exports Value Month of May			Imports Value Month of May		
	1949 £	1950 £	1951 £	1949 £	1950 £	1951 £
Telegraph and Telephone Wires and Cables—						
Submarine	24,203	66,307	12,711			
Other	609,487	626,248	556,098	3,357	5,281	5,150
Rubber Insulated	489,638	286,036	538,880			
Insulated, other than Rubber	1,161,689	875,089	1,019,841			
Wireless Apparatus, including Valves	1,052,802	1,268,280	2,124,999	79,009	182,793	272,787
Telephone and Telegraph Apparatus	1,273,799	1,420,250	1,137,776	—	—	—
Electric Lighting Appliances, Accessories, Fittings and Parts:—						
Filament Lamp Bulbs	115,001	93,010	146,204	13,309	15,781	17,850
Other Descriptions	409,599	294,905	361,082	4,640	28,093	51,017
Batteries (primary)	125,221	99,059	249,823	—	—	—
Accumulators, Portable	199,718	210,957	366,475	—	—	—
,, Stationary	39,708	131,634	51,292	—	—	—
,, Parts and Accessories	88,538	59,047	56,614	—	—	—
Electrical Cooking and Heating Appliances	287,022	218,535	458,279	—	—	—
Ammeters, Voltmeters, etc., and Parts	98,340	88,043	134,036			
House Service Meters	156,451	109,897	106,573	30,277	35,292	47,051
All Other Instruments	115,264	132,498	186,458			
Electro-Medical Apparatus	33,268	39,895	60,077	—	—	—
X-Ray Apparatus, etc.	88,601	65,068	123,041	39,384	15,924	31,879
Insulating Materials	147,399	172,839	224,184	—	—	—
All Other Articles	489,289	448,789	569,503	124,749	120,492	102,493
TOTAL OF GROUP	7,005,037	6,706,386	8,483,946	294,725	403,656	528,227
Electrical Machinery:—						
Generating Sets (Diesel)*—						
Not exceeding 200 kW		835,041	415,694			
Exceeding 200 kW	762,405	141,007	342,278	28,543	42,099	73,942
Other Generating Sets		207,959	86,771			
Generators minus Prime Movers, and Parts†		202,143	341,525			
Motors	807,195	712,182	873,793	29,065	34,044	35,020
Convertors, Transformers, Rectifiers, Motor Control Gear, Switchgear, other machinery	1,414,157	1,770,341	2,125,597	8,338	13,845	27,982
Fans, Electrically and Power Driven	100,064	137,501	177,680	—	—	—
Vacuum Cleaners or Electrically Operated Appliances	268,792	298,656	517,390	—	—	—
TOTAL APPLIANCES AND MACHINERY	10,357,647	11,011,216	13,364,674	360,671	493,644	665,171

* 1950 figures include generators minus prime movers. †1950 figures, for parts of generators only.

Induced Draught Towers

A TEAM of three, Messrs. B. T. Metcalf, P. M. Marson and F. B. Karthauser visited Germany last year to investigate the potentialities of induced draught cooling towers as compared with the more usual natural draught structures generally used in this country. Their findings have now been published in Information Bulletin No. EG(51)8 of the N.C.B. (Production Dept.).

They point out that German engineers claim that the induced draught design has the advantages of lower first cost, requiring less space, capability of cooling through a wide range, and using only 50% of the water throughput. This latter point leads naturally to reduction in first cost of pumps and water pipes, and lower power consumption—thus compensating for the fan load.

The usual construction is somewhat similar to the venturi-tube type towers used in this country. At the narrowest point of the throat is a horizontal fan rotating at about 90 r.p.m. and driven by a vertical shaft from gearing located in the base of the tower. As the speed of the fan is controlled by the temperature of the cold water, power is not wasted when the ambient temperature falls.

A natural draught tower for 30 MW uses about 570 kW in pumping compared with 310 kW for induced-draught. To the latter must be added 280 kW for the fan drive. In the weather conditions in Germany it is assumed the fan is only needed for 60% of the time the tower is operating, so that 170 kW can be taken as the mean fan load.

It is admitted, however, that higher carry-over is experienced and that make-up water may present a serious problem at times of water shortage.

Figures are given contrasting the approximate costs of natural draught and fan-cooling towers in Germany. A normal steel and wood natural draught would cost about £31,100 compared with £25,150 for the equivalent fan cooling item. For strengthened steel and wood towers, the figures are £52,300 and £33,450 respectively, and a concrete strengthened fan-cooling tower would come out at about £38,900. All are assumed to have a capacity of 180 million B.Th.U./hour. The throughput to the natural draught tower, however, is 1,760,000 gal/hour compared with 880,000 gal/hour with induced, and the temperature ranges are 88°-77°F for the former and 90°-68°F for the latter.

AUSTRALIAN RAIL ELECTRIFICATION

By CHARLES LYNCH

THE Gippsland railway line in the Australian state of Victoria which is to be electrified in 1953 has aroused considerable technical interest in overseas countries.

The line is to be electrified from Melbourne to Traralgon, a distance of 97 miles, but it is expected that trains will run from Melbourne to Warragul, a distance of 65 miles, several months before the completion of the whole section.

Electrical energy will be supplied by the State Electricity Commission, and at each of four supply points on the route, transmission lines will run to supply traction substations with alternating current at a pressure of 22 kV, 3-phase, 50 cycles. Mercury arc rectifiers will be used as converting plant.

The Victorian Ministry of Transport has planned for 16 traction substations (6 double-unit and 10 single-unit) where the a.c., at 22 kV, will be converted to d.c. at 1,500 V. This will be fed to the overhead contact wire system via high-speed circuit-breakers.

The 1,500-V overhead contact wire system will be sectionalised at substations, and in some cases at intermediate points between substations where tie-stations will be installed. It is planned to have 12 tie-stations, in which high-speed circuit-breakers of the same type as used in the substations will be provided. These circuit-breakers operate at sufficiently high speed to clear the overhead circuit they feed, in the event of fault, before any appreciable damage can be done.

Operation

All the substations and the stations will be unattended and the equipment in them will be automatic. The equipment will be under the control and supervision of a power operations engineer located in a central depot which is to be erected at Warragul.

Each substation and tie-station will be connected to the power operations room by means of two telephone wires through which supervisory equipment will be operated.

In the power operations room there will be a control desk and control diagram. Small red and green lamps in the diagram will indicate the condition of all rectifiers and circuit-breakers to be controlled or supervised. Keys on the control desk will enable the power operations engineer to open or close any of the circuit-breakers or rectifiers on the system.

Initially, the power operations engineer will have control of 22 rectifiers, 71 high-speed circuit-breakers and 22 high-tension feeder oil circuit-breakers.

Telephone facilities will also be provided between the power operations room and all substations and tie-stations.

THE WEEK

COMMERCE *in news* INDUSTRY

Exports to China and Hong Kong

A FULL list of goods which cannot be exported to China was given by Sir Hartley Shawcross, President of the Board of Trade, in the House of Commons last week. Readers will recall that last month the U.N. recommended that every State should apply an embargo on shipments to China of items useful in the production of arms, and asked those States to determine which commodities fell within the embargo. Accordingly the Government has decided to impose export licence controls on all goods intended for China and Hong Kong, and a relevant Order which became operative on Monday has been issued. Licenses for goods not considered of military importance will be given freely, but licences for those goods included in the list drawn up by the Government will only be given in the case of exports to Hong Kong, and then only if the authorities there give an assurance that the same goods will not find their way to China. As far as the electrical industry is concerned, electric generators and motors, compressors for wind tunnels, portable power tools and welding machines and electrodes are covered by the list. Other items are electronic equipment, including radio and radar, under which heading appear cables and tissues for use in electrical apparatus, and precision and scientific instruments, and strategic grades of mica.

Lighting in the U.S.

ACTIVE promotion of home lighting was more important now than ever before, said Mr. WILLARD C. BROWN, head of the Lighting Division of the General Electric Co. (U.S.), at a lunch on Tuesday of last week. Speaking of the situation in the U.S., he said that since the war a new era had arrived—customers were buying lighting, instead of having it sold to them. This was understandable enough in industry, which needed more light from the point of view of employee welfare, let alone from the standpoint of maximum productivity, but the demand was coming from outside industry, stores and schools being among the first, all wanting more light—preferably at no extra cost. After 20 years research in the U.S., they had arrived at the point where the message appeared to have sunk in, and customers were practically taking the goods off their shelves rather than waiting to be sold. Today the consumption of electricity in the U.S. for lighting was about three-quarters of the amount of the total industrial load ten years ago, and another point of interest was that the I.E.S. of America was now 7,200 strong.

Mr. Willard Brown, who was visiting this country for the first time for 11 years, has succeeded to the position previously held by Mr. WARD HARRISON until his recent retirement. He was speaking at a private lunch given by Mr. V. H. C. CREER, M.A. (Director Lamp and Lighting Sales, B.T.H. Co. Ltd.) and Mrs. Creer. Mrs. WILLARD BROWN, Mr. and Mrs. CUTLER (G.E.), SIR CHARLES MOLE of the Ministry of Works, and a number of executives in the lighting industry and their wives, were amongst the guests.

Restrictions on Cellulose Film

AS a result of the restrictions imposed on the output of cellulose film by the sulphur shortage, the Board of Trade has announced that cellulose film will no longer be supplied for a number of less essential uses (particularly wrapping) in the home market. Firms affected will, however, be allowed to use up stocks at present in their possession. In future the film may not be used for the following goods:—

Wireless and radio sets	Washing machines
Radio valves	Insulating tape
Refrigerators	Bulbs
Vacuum cleaners	Wire
Batteries and cases	Toasters and Irons

Most of the supply will be conserved for direct export or for the wrapping of goods for export.

Engineer's Suggestion wins £10

AN award of £10 has been presented to Mr. J. A. Wright, assistant district engineer in Central Cornwall district of S.W. Electricity Board, under the Board's suggestion scheme launched last August. The scheme, also being operated in a number of other areas, is designed to encourage suggestions for improving efficiency in any of the Board's departments, and is open to all employees. Mr. Wright's proposal concerned the melting and running off of the compound in sealing boxes.

The First Half-Century

The most welcome news to be recorded this week is the passing of Sir John Kennaway's select committee of the London United Tramways Extension Bill, unsaddled by an insulated return or the iniquitous electrolysis clause. This is a notable triumph for electric traction; and a correspondingly severe rebuff for the allied gas and water interests.—*From our issue of June* 27, 1901.

Instead of using paraffin blowlamps, which require a skilled worker and which usually involve the waste of the compound, it was suggested that infra-red lamps be used. These, the winner states, save time, are cheaper to run, and do not need such skilled supervision. Moreover, the compound can be run off, stored and re-used.

The suggestion has been recommended for adoption throughout the area, and when it has been in operation for six months, the experiment will be reviewed. If successful a further award may be made. Meanwhile at an informal ceremony at Truro, the Board's chairman, Mr. S. F. Steward, handed over the cheque to the winner.

Full House at Radio Convention

THE British Institution of Radio Engineers has announced that no further applications for tickets can be accepted for the first part of the I.R.E. Convention to be held at University College, London. We understand that the demand for tickets has been so overwhelming that if all applications were granted it would be impossible to accommodate the delegates. The two sessions to be held in London are on "Electronic Instrumentation and Valve Technology," and will take place between July 3 and 6. Other sessions of the Convention will be held at University College, Southampton, from July 24 to 27, at King's College, Cambridge, from August 21 to 24, and at Earls Court, London, between September 4 and 6. Tickets for these are still available, but the Institution advises early application to the Institution at 9 Bedford Square, W.C.1.

Certain Pension Rights Retained

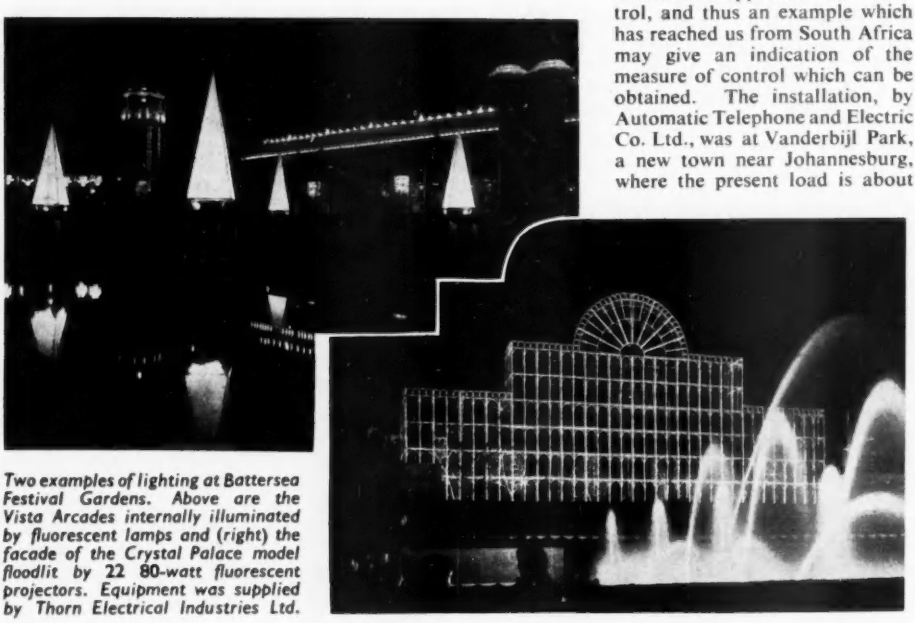
MANY members of the old Northmet (Staff) Pension Fund and the First Garden City Staff Benefit Society are affected by a new Statutory Instrument (No. 1079) which operates from July 1. These regulations provide that the former scheme shall not be split up, but maintained jointly by the Boards, and any members not in Electricity Board employment can continue in membership. In regard to the second, persons formerly employed by Letchworth Electricity Ltd., are to retain certain rights of the old scheme.

Summer School to be Repeated

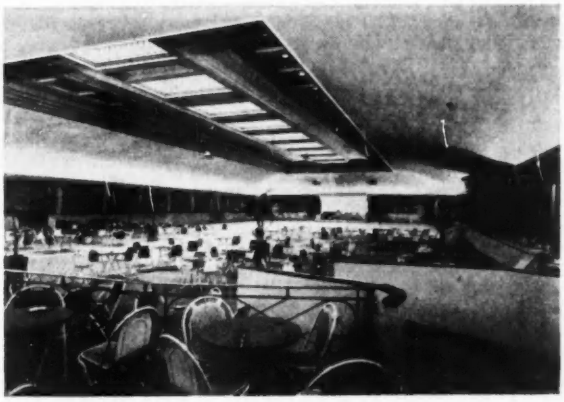
WE hear that over 200 students, including some from Holland, Belgium and Norway, attended the British Welding Research Association's summer school on "Welding Design and Engineering." It was held at Ashorne Hill, near Leamington Spa, between May 25 and June 2, and proved so successful that the Association has decided to hold a similar function next year. Provisional bookings have already been made at Ashorne Hill for 1952 with this object in mind, and it is hoped that details will be released shortly. During the week of the course just completed there were no less than 63 lectures, seven discussions and about eight hours of film shows, all of which provided a busy programme.

Load-shedding by Ripple Control

THE installations of "Rythmatic" ripple control in this country have not given electrical engineers much opportunity to assess these methods as applied to load control, and thus an example which has reached us from South Africa may give an indication of the measure of control which can be obtained. The installation, by Automatic Telephone and Electric Co. Ltd., was at Vanderbijl Park, a new town near Johannesburg, where the present load is about



Two examples of lighting at Battersea Festival Gardens. Above are the Vista Arcades internally illuminated by fluorescent lamps and (right) the facade of the Crystal Palace model floodlit by 22 80-watt fluorescent projectors. Equipment was supplied by Thorn Electrical Industries Ltd.



A view of the Orchid Ballroom, Purley, where G.E.C. fittings have been suitably adjusted from the lighting scheme used while the building was an ice rink

5 MW. It was found that there was insufficient power to meet the requirements of both the large factory and the surrounding housing estate—a predicament often encountered nowadays in this country.

The equipment was required to switch water heaters on and off, similarly control street lights at dusk, midnight and dawn, and provide an alarm signal with two spare signals.

A supply of contact ammeters will be arranged to inject load shedding and restoring signals automatically at pre-determined trial load values. The signal is injected in series with the 11 kV main feeder, thus ensuring that ripple power may be applied to energise only those feeders on which it is desired to exercise control. It has been found that by selective switching off of the water-heater load the total load was reduced by some 25%.

At home possibly one of the largest installations of this kind is shortly to be carried out at Leeds, and the Y.E.B's No. 4 sub-area has placed an order for equipment to cover the city. The City Council's lighting department is contracting with the Board for the provision of signal injection equipment. The relays are to be bought by the Council direct and 5,000 are expected to be commissioned during the first year.

An Economical Transformation

ACCORDING to the circumstances and purpose for which a room or hall is to be used, so different types of lighting are required. The "hard" colour of a sports arena would not, for instance, be the most suitable kind for the soft atmosphere of social gatherings and parties. Thus when the Purley (Surrey) ice rink was transformed into the Orchid Ballroom, one of the most important alterations was to do with lighting. This was ultimately effected with an economy of material which should encourage similar schemes under consideration elsewhere.

The ice rink had been illuminated by daylight cold cathode tubes in standard G.E.C. 3-tube units. In the new installation the same 67 fittings are retained but are now mounted on their backs in a wide cornice so that the main lighting is indirect. One cerise colour tube with two daylight in each fitting instead of the more usual daylight and gold combination, permits the retention of existing transformers. Eight R.L.M. reflectors with 200 W lamps have been mounted above each of nine laylights, and a series of 36 of these reflectors are also mounted above apertures to take colour screens. Contractors for this work were Electrical Installations Ltd.

Euston Resignalling

THE contract for the resignalling of Euston terminus for British Railways has been given to the Westinghouse Brake and Signal Co. Ltd., who will be responsible for the supply and installation of the vast majority of the whole apparatus. This will include 100 sets of electro-pneumatic facing point layouts involving the installation of about 2½ miles of air main and branch piping, 110 a.c. condenser fed track circuits, 31 field locations, 1,000 a.c. relays and compressor plant. The 227-lever all-electric power frame to be installed was built some years ago and held by the railway as war emergency stock. British Railways are to provide and fix the 34 main colour light signals and 36 ground light signals, the cable and a 60 kW diesel alternator for emergency standby supply. Although electro-pneumatic point operation has been used extensively on London Transport lines and at York, Hull and Glasgow, Euston will be the first main line terminus in London to be so equipped.

"Housing Manual" Appendix

THE technical appendix to the Ministry of Works and Ministry of Local Government and Planning's Housing Manual, 1949 has now been published, and performs the same function for that volume as its predecessor did for the 1944 manual, but has been revised and brought up to date in the light of recent building research. A section on heating and water heating contains a number of references to the relevant Codes of Practice. It is obtainable from H.M. Stationery Office, price 2s.

B.E.A. Research Council

THE Research Council of the B.E.A. wants to include in its deliberations the methods adopted by Westminster City Council for the Pimlico scheme, and to study the cost of heat so supplied in relation to the cost of other methods. For this purpose a Pimlico District Heating Sub-Committee has been appointed. The Council has been formed to carry out research and investigate improve-

ments in the generation and distribution of electricity, together with the problem of efficiency. The duties of the sub-committee will include a recording of the operational efficiency of the Pimlico undertaking, and will cover both the heat-electric plant at Battersea power station and the storage and distribution of heat by the City Council.

Danes use All-Plastic Cables

PART of the scheme of expansion being carried out by the Copenhagen Telephone Co. in Denmark comprises the laying of all-plastic carrier-frequency multiquad underground cable made by the Telephone Construction and Maintenance Co. Ltd. Telcon research led to the introduction of Telcothene, the strong and flexible synthetic thermoplastic based on polythene, as an insulating medium in radar and aeronautical communications, and the application of these experiments to land telephone systems has followed naturally. The new plastic type cable now being used in Denmark has been designed to provide 48 speech channels per pair—there are two 12-quad cables for two-way transmission—in a frequency band from 12 to 204 kc/s. Further research is now proceeding in the use of carrier type Telcothene cables, and it is anticipated that 60 speech channels per pair will be achieved in the near future.

Prospects in Ontario

A BECOMING and enterprising brochure has just been published by the Trade and Industry Department of Ontario in London. It is entitled "In Ontario Your Plant Will Grow," and in about twenty minutes of easy reading, facts about the State's resources, skilled labour, power, transport and raw materials are assembled for scrutiny by businessmen in this country contemplating trade in Canada. The section devoted to the Ontario Hydro-Electric Power Commission alone offers many prospects for the electrical industry in Britain. Copies of the booklet and any further information may be obtained from the above department at Ontario House, Charles II St., S.W.1.

Magnet House Retains Trophy

FOR the third year in succession, Head Office won the Leslie Gamage Trophy for the highest aggregate score in the G.E.C. (London district) sports, held at North Wembley on June 23. Total points scored were 35, runners-up being Coldair, 27; Osram Lamp Works, 21; Fraser and Chalmers, 14; Research Labs., 13; and Union Works, 6. This is the seventh time they have won the trophy in the 13 times for which it has been competed at this event. A large crowd of employees and their friends attended the sports which, as usual, combined the attractions of a first-class athletic display with side-shows and amusements and a well-patronised Children's Corner. Prizes, including a number of championship trophies for individual events, were presented by the Hon. Mrs. Leslie Gamage.

The G.E.C. Witton sports were held on June 16, when more than 3,000 saw their own team win the Midland Works and Business Houses Association relay race for the fourth year in succession. Lady Railing, O.B.E., presented the prizes on this occasion.

Khaperkheda Power Station

The description of the above station in our issue of last week is in error regarding feed-water pumps. It should be noted that there are three 125 k lb/hr electrically driven feed pumps for the station (i.e. one for every two boilers), with two steam-driven pumps as a stand-by. It should also be made clear that Lt.-Col. E. G. Mackie, to whom acknowledgement is made in the article, is Chief Engineer as well as Chairman of the State Electricity Board.

NEWS IN BRIEF

A new Order consolidating export licensing regulations has been published by the Board of Trade. The Export of Goods (Control) Order, 1951 brings up to date the Consolidation Order, 1950 with all subsequent amendments.

The Illuminating Engineering Society has announced that its summer meeting next year will be held at Eastbourne between May 20 and 23.

Copies of the Bill to consolidate Customs and Excise laws will shortly be sent to associations representing trades and industries directly concerned. A committee under the chairmanship of Lord Kennet was appointed recently to examine the new draft Bill.

The Hon. Mrs. Leslie Gamage presenting the prizes for the children's events at the G.E.C. Sports at Wembley last Saturday

Overseas attendance at the first British Plastics Exhibition at Olympia, which closed on June 16, was over 1,500. Countries represented numbered 35.

A party of 400 employees of John Thompson Ltd., Wolverhampton, attended a week-end conference at Pwllheli. The party included directors, works managers, supervisors, wives and families, and also apprentices.

Attendance during the four days of the 1951 Industrial Safety Exhibition in Birmingham was 9,314.

The G.E.C. is supplying 12,055 shoulder light fittings and connecting sockets for new standard passenger coaches on British Railways. The fittings are die cast in a zinc-based alloy and finished matt chrome, and each includes a self-contained switch and local fuse.

Questions in Parliament

Capital Investment

In his statement last Thursday on the Government's policy in regard to capital investment, the Chancellor of the Exchequer said the heavy new demands of the defence programme on the engineering industries must involve some check to civil investment at home. The total output of those industries was limited by shortages of steel and other materials, and we could not afford a serious decline in exports of metal goods. In 1951 there will be no increase in supplies of plant and machinery available for home industry : in 1952 and 1953 there must be a substantial reduction. Of the plant and machinery that is available for the home market a much larger share must from now on go to firms engaged on defence production so that even this year there will be some fall in supplies for purely civil purposes. In the next two years some parts of the civil building programme are bound to be delayed in areas where important defence works have to be executed. In view of the greater uncertainty caused by the impact of defence production and material shortages, it was not proposed to publish for 1951 or 1952 a detailed investment programme as in previous years with figures for individual industries.

The total fixed investment in 1951, including a substantial amount of defence investment, may amount to £2,230 millions (in terms of prices ruling at the end of 1950), compared with £2,162 millions in 1950. Within this total it is intended that investment in coal, electricity, gas, coke-ovens, railways, roads, and petroleum will be higher (substantially higher for coal and electricity) than in 1950. New building for other industries will remain at about the same rate as in 1950, but there will be fewer licences for ordinary civil projects.

Contribution to B.S.I.

The Government has decided to accept the recommendations of the Cunliffe Report on the organisation, procedure, constitution and public relations activities of the British Standards Institution, Sir Hartley Shawcross stated in a written reply on Thursday last. A continuing financial contribution from the Exchequer, based upon the amount of industrial subscriptions, was recognised as desirable, he said, but in view of the uncertainty of the future, the Government was unable to accept commitment in respect of the whole five-year term proposed in the report. It is, however, prepared to be committed for three years (including the present financial year), the matter being reconsidered at the end of that term. This proposal the Institution has accepted. It had also been agreed that, in view of the shorter term, it would be appropriate that the maximum Government contribution should be at a level which, while giving the Institution a target which it would take considerable efforts to reach, was lower than that provided for in the report.

P.T. on Radio Goods

The Ministry of Supply has placed orders with the radio industry for about £50 million worth of products, Mr. J. Edwards stated during further discussion on the Finance Bill on a proposal to reduce purchase tax on radio and television sets, valves and cathode-ray tubes. Mr. Orr-Ewing put forward the motion indicating that the industry was pulling its weight in regard to exports. He was supported by Mr. McAdden (Southend) and Mr. Kerr (Cambridge) and others, but Mr. Edwards pointed out that last year home purchases of radio sets amounted to £18,500,000, exports being worth £3,500,000; home sales of television sets was £17,750,000, so he felt that there was no likelihood that the industry would be in difficulty in developing export markets because it had not a firm home basis. The amendment was negatived.

Shop Lighting

When asked if he would give an assurance that shop window and sign lighting would be possible in the darker days later in the year to enable shopping to be conducted in greater comfort than was possible last winter, Mr. Noel-Baker replied that it was of the greatest importance to reduce the frequency and severity of power cuts. He was now considering what measures would be required to enable this to be done.

H.E. Projects

The B.E.A. have under consideration a number of hydro-electric projects of small and medium size, and investigations were proceeding to see whether they would be economically sound, Mr. Noel-Baker stated in a written reply.

Electric Supply News

Cowes (I.o.W.)

The Harbour Commissioners have again asked that the cable over the Medina should be laid in the bed of the river. It was decided to inform the Ministry that the commissioners adhered to their original opinion that any cable should be under the water and that an overhead cable was likely to cause an obstruction to navigation.

Durham

The county Urban District Councils Association is obtaining the views of its members regarding terms for supplying electricity to new housing estates, by the North Eastern Electricity Board. Seaham U.D.C., which has considered the question, has decided to support proposals including the following:—

Substation sites to be sold outright to the Electricity Board and not rented; the Board to pay interest on the cost of the land upon which approach roads are constructed; the Board to provide cable ducts at its own expense across carriageways; the local authorities at their own cost to place the ducts into the road; the Board to supply ducts and information as to where they are to be placed before the road is constructed, and in the event of the Board failing to do so, the work of laying the ducts to be carried out by the Board at its own expense. The Council also recommends that negotiations be opened with the Board for the suppression of noise from substations.

Eire

Rationing of electricity by ration card, which was discontinued shortly after the last emergency, is to be reintroduced. Already 80,000 consumers have received their cards and the remainder will get theirs inside the next few weeks. The cards specify the basic consumptions for six two-monthly periods last year and on these the rations will have to be based. In effect, rationing has been in force since the Board announced its restrictions a few weeks ago, but the cards are being issued to guide the consumer in arriving at his ration so that there will be no excuse if the ration is exceeded. This rationing scheme is to continue even though the 10 weeks' old dispute at the Pigeon House generating station ended last Thursday. In that, certain employees had banned overtime in protest at an offer of a wage increase. But after a ballot, it was decided to accept the offer of 1½d. an hour increase for semi-skilled men. About 90 men have been upgraded from unskilled to semi-skilled status, we learn.

Elland

The Council has now been informed that the B.E.A. have satisfied themselves as to the necessity and practicability of building a power station on land owned by the Council at Lowfields, Elland, and that they now wish to proceed with the development of plans. Application is to be made for formal consent.

North of Scotland

Criticism of the service charges imposed by the North of Scotland Hydro-Electric Board for the installation of electricity supplies was expressed at the annual general meeting of the Local Authorities Hydro-Electric General Committee last week. The Chairman, Lt.-Gen. Sir James Gammell, said there was no doubt there was a feeling that the Hydro Board were not implementing the original conception of their charter. The Board were asking for very considerable capital sums, far beyond the reach of people in isolated areas, before electricity was installed at all. The town clerk of Forfar, Mr. H. Grant, described as an unsatisfactory state of affairs the service charges for a housing scheme in his area varying from £2 10s. to £30. The committee unanimously decided to ask the Board to clarify certain matters in connection with the supply of electricity. If the Board had statutory authority for making such charges, the principles upon which they were based should be clearly explained to potential consumers. The committee considered, however, that the imposition of heavy capital charges since the nationalisation of electricity was wrong, and did not fulfil the charter given to the Board.

LIGHTING SCHEMES

Anstruther.—T.C. is to seek approval of the M.o.T. to a scheme for electric street lighting in Anstruther and part of Cellardyke. It is proposed to obtain a loan of £3,500 for the work.

Colwyn Bay.—The T.C. has rejected a proposal that strip and decorative lighting be provided along the whole length of the promenade.

Heywood (Lancs).—The Lighting Department is now working on the next stage in a £16,000 gas to electricity street lighting conversion scheme.

Houghton-le-Spring.—U.D.C. to invite tenders for completing the conversion from gas to electricity of the light system on road A.182 between Grasswell and the Queen's Head Inn, Newbottle. Plans by Mr. W. H. Smith, surveyor.

Kensington.—The borough engineer has prepared a scheme for fluorescent lighting in Brompton Road between Thurloe Place and Hoopers Court, at an estimated cost of £2,972.

Liverpool.—Experiments for a completely new system of lighting the Mersey Tunnel are being made, the Corporation Lighting Committee has reported.

Turton.—The U.D.C. is to consider a scheme for improving street lighting on Darwen Road and Blackburn Road.

Warrington.—The Corporation has approved a recommendation to substitute electric lighting for gas in Knutsford Road and Bridge Foot. Application is to be made for consent to borrow £6,216 for the work.

Company Activities

Aerialite Ltd.

The Capital Issues Committee has given permission to issue new capital which is to be offered in the form of Ordinary Preference shares to existing holders.

Aron Electricity Meters

For the year to March 31, the profit is £86,523 (*£59,554*). Taxation absorbs £49,510 (*£35,078*). Add surplus tax provisions, £7,846 (*£4,847*). Off investments, £8,680 (*nil*); to reserves. £18,000 (*£15,120*). There is a dividend of 15% (*same*), and £34,811 (*£28,597*) is carried forward.

Associated Electrical Industries Ltd.

At the time of the annual general meeting, the directors announced their intent on of submitting to the stockholders proposals for the conversion of 8% Preference Stock into 4½% Preference Stock, and the issue of further Ordinary and 4½% Preference shares. On Wednesday next, July 4 stockholders will receive details of the directors' proposals, meetings having been called for July 27.

British Electric Traction

The group's aggregate net profit for 1950-51 is £1,211,426 (*£1,350,266*) after providing £850,804 (*£921,340*) for taxation. The net profit of the parent company is £639,247 (*£638,031*). There is a final dividend on the Deferred Ordinary and "A" Deferred Ordinary of 17½% (*same*), making 25%, and absorbing in all £315,806. Last year a total of 32½% (£141,347) was paid on Deferred and 17½% (£152,220) on the "A" Deferred—which class represented the two-for-one bonus during 1949-50. After provision for all dividends there is a balance of £235,942 (*£254,748*) to be carried to the undivided profits account. Revenue reserves and undivided profits of the parent company have increased by £265,570.

Campbell and Isherwood

Profit for 1950 is £56,668 (*£72,981*) before charging taxation of £34,606 (*£42,386*). There is a dividend of 20% on the £82,460 Ordinary shares, as was forecast when the company was made public in May, 1949.

Delhi Electric Supply and Traction

The liquidators state that the assets in their hand or under their control at May 24 comprised: cash, liquidator's account, £48,500; companies liquidation account, £200,000. Other assets, tax certificates, £189,625, making the total £438,125. In addition there was a balance of about £3,130 on the bank account at Delhi. These resources are available after providing for the first distribution of 30s. per share (taking £300,000). There is no possibility of any further distribution until objections against certain claims have been disposed of.

Hackbridge & Hewittic Electric Co.

There is a group trading profit for the year to March 31 last of £379,331, against £339,999 for the previous year, according to the preliminary statement. The final dividend is increased from 11% to 13%, making 18% (*15%*). After providing depreciation and fees and £196,150 (*£158,000*) for taxation, the net profit is £142,720 (*£135,015*). The allocation to reserve is £80,000 (*£57,500*), a further £5,000 to directors' pensions, leaving a carry forward of £39,466 (*£37,491*).

Mirrlees Watson Ltd.

An increase of 4½%, to 12½%, on the Ordinary shares is recommended. This is payable on the capital as increased last year by a 1-for-14 share bonus. With £18,148 brought in, there is £109,955 (*£85,800*) available. To general reserve £50,000 (*£45,000*).

Pye Ltd.

Group profit for 1950-51 is £543,149 compared with £400,859 for the previous twelve months. On the Participating Preferred Ordinary stock there is a final dividend of 3% and participating of 2%, making 10% (*same*). On the Deferred Ordinary the dividend is 12½%, plus 5%, from dividend reserve, making 18% on the capital which was doubled by the bonus issue. Taxation provision is £353,956 (*£229,069*), the profit attributable to the holding company being £539,469 (*£400,749*). Under the profit-sharing scheme, the employees receive £32,000 (*£24,000*), and the sum of £32,000 (*£16,000*) is transferred to dividend reserve.

Revo Electric Co.

For the year to March 31 last, the net profit after all charges, including taxation, is £121,763 compared with £113,719 for the preceding twelve months. The final dividend is 12½% plus bonus 10%, making 27½% (*same*).

Rheostatic Co. Ltd.

A meeting is to be held on July 9, to consider proposals of the directors for the raising of further capital. The issues envisaged comprise 60,000 6% 10s. Preference units to existing Preference holders on the basis of 3 for 8, and 245,000 4s. Ordinary units in the proportion of one for every three Ordinary held.

Walsall Conduits Ltd.

The group trading profit for 1950, before taxation, amounts to £396,004 (*£313,590*), which is wholly attributable to members of the holding company. Taxation takes £176,983 (*£166,009*). There is a final Ordinary dividend of 35% and bonus 15%, making 70% (*same*). The sum of £483,638 (*£347,933*) is carried forward.

Dividends Declared

Drake and Gorham. Dividend of 5% (*same*).

Greenwood and Batley. Final Ordinary dividend 10%, making 15% (*same*). Net profit £51,001 (*£63,962*).

Commercial Information

CONTRACTS OPEN

HOME

June 29.—Bacup T.C. Electrical work in construction of 6 bungalows on Huttock End site. Borough Engineer, Municipal Offices. Deposit £2 2s.

June 29.—Berkshire. Supply and erection of 12 sodium lighting units for Hinksey Hill roundabout on trunk road A.34. County Surveyor, Shire Hall, Reading. Deposit £1 1s.

June 29.—Brecon. Electrical installation at Maesydderwen Bilateral secondary modern school. Harley C. W. Strickland, County Architect, Rhyd Offices, Brecon. Deposit £3 3s.

June 29.—Bury T.C. Electrical installation for lighting and power at Fernhill Yard, Todd St. Borough Engineer, Town Hall. Deposit £1 1s.

June 29.—Fife. Electrical work in 8 houses at Kingsbarns. C. R. Douglas and Co., Surveyors, 15 East Port, Dunfermline.

June 29.—Sunderland. Electrical installation in a number of schools in the borough. Borough Architect, Grange House, Stockton Rd. Deposit £2 2s. (See June 7 issue.)

June 30.—Banbury T.C. Supply and erection of two electrically driven centrifugal pumps and ancillary equipment at Grimsbury. Water Engineer and Manager, Town Hall. Deposit £5 5s.

June 30.—East Kesteven R.D.C. Supply, erection and maintenance of pumping machinery—two pumps of stereophagus or unchokable type complete with electric motor and automatic switchgear. Council Offices, Northgate, Sleaford. Deposit £3.

June 30.—Hyde (Cheshire) T.C. Electric wiring installation to 42 dwellings on Harbour Farm estate. Borough Surveyor, Municipal Buildings. Deposit £1 1s.

June 30.—Jarrow T.C. Firms desirous of tendering for supply of materials for electrical installations in new housing schemes during year beginning July 1, should submit names to Borough Engineer, Town Hall, by above date.

June 30.—Kirkburton (Yorks) U.D.C. Wiring of 4 houses at Rose Terrace. D. J. D. Woodhall, Municipal Engineer, Town Hall.

June 30.—Lowestoft T.C. Electrical installation in buildings at Yarmouth Rd. grammar school. Borough Engineer's Dept., Town Hall. Deposit £1 1s.

June 30.—N. Ireland. Supply and installation of electric light and bell circuits at Marmion, Church Rd., Holywood. D. Whatmore Bell, 41 Royal Ave., Belfast. Deposit £3 3s.

June 30.—Tayport T.C. Electrical work in erection of block of 22 houses. Walker and Pride, Church Square, St. Andrews.

June 30.—Westmeath. Supply and installation of electrically driven, automatically controlled sewage pump capable of discharging 500 g.p.m. P. J. Keane, acting secretary, County Bldgs., Mullingar.

June 30.—Worsley U.D.C. Supply of concrete columns, lanterns, lamps and all auxiliary equipment for street lighting along about four miles of trunk road A.6. Engineer and Surveyor, Town Hall, Walkden, Manchester. Deposit £2 2s.

July 2.—Clare. Supply of (among other items) electric air-cooled stationary compressor. County Engineer, County House, Ennis.

July 2.—Lisburn U.D.C. Electrical installation at council's waterworks, Pond Park. Town Surveyor, Town Hall. Deposit £2.

July 2.—Preston T.C. Electrical installation in six houses on Larches estate, Ashton-on-Ribble. Borough Engineer and Surveyor, Municipal Building. Deposit £2 2s. (See June 21 issue.)

July 4.—Cleethorpes T.C. Electrical installation in 96 houses on Highgate and Davenport Drive sites. A. B. Cooper, borough engineer, Council House. Deposit £2 2s.

July 4.—Dublin. Supply and installation of an electric service lift and automatic cold room at Grangegorman mental hospital. E. M. Murray, chief clerk, Grangegorman Hospital, Dublin.

July 4.—Newcastle-under-Lyme T.C. Supply and installation of lanterns, 150 W tungsten filament lamps, control gear and concrete standards for Group B lighting on various estate roads. Borough Engineer and Surveyor, Lancaster Building, High St., Newcastle, Staffs. Deposit £1. (See June 21 issue.)

July 4.—Sale T.C. Wiring and installation of electric lighting and power points in 40 dwellings on Baguley Lane estate. Borough Surveyor, Town Hall. Deposit £2 2s.

July 5.—Edinburgh. Installation of electric light and power at Heriot-Watt College. City Architect, City Chambers, Edinburgh 1.

July 5.—Manchester. Electrical installation at Button Lane Primary School, Wythenshawe. City Architect, Town Hall. Deposit £1 1s. (See June 7 issue.)

July 6.—Beckenham (Kent) T.C. Supply of 125 2 kW convector heaters. Borough Engineer, Town Hall. (Advertised in this issue.)

July 6.—Bingley U.D.C. Supply, erection and installation of 52 street lighting columns, lanterns and auxiliary equipment in Park Rd. J. S. Lattin, Engineer and Surveyor, Town Hall. Deposit £2 2s. (See June 14 issue.)

July 6.—Manchester. Replacement of electric cables to homes at "Newholme," Nell Lane, West Didsbury. City Architect, Town Hall. Deposit £1 1s. (See June 21 issue.)

July 7.—Reigate T.C. Supply and installation of two sludge ejectors, with electrically driven air compressors, starters, pipework and valves. G. G. Sanderson, Borough Engineer and Surveyor, Town Hall.

July 9.—Bingley U.D.C. Supply and erection of 28 street-lighting columns, lanterns and auxiliary equipment on Cottingley site. J. S. Lattin, Engineer and Surveyor, Town Hall. Deposit £2 2s. (Advertised in this issue.)

July 9.—Farnborough U.D.C. Provision of street lighting along about 225 yd. of Sandhill, being

part of street works. I. C. Jenkins, Council's Engineer and Surveyor, Town Hall. Deposit £3 3s.

July 9.—N. Ireland. Supply of electric bread slicer, floor polisher and food mixer for Coleraine and Portrush Hospital Management Committee. Secretary of Committee, Bann View Hospital, Coleraine.

July 9.—Preston T.C. Electrical services included in work on modernisation of laundry at Fulwood Civic Hostel. Richard R. Jennings, Consulting Engineer, 35 Byron St., Deansgate, Manchester 3.

July 9.—Ryton-on-Tyne U.D.C. Electric lighting and heating in 9 old people's houses on Runhead estate. Surveyor, Council Offices, Ryton Tower, Ryton.

July 10.—Kendal T.C. Provision and installation of 92 mercury vapour lighting units, 25 fluorescent units, and supply and erection of concrete columns, fitting of lanterns with all auxiliary equipment and wiring. Borough Engineer and Surveyor, Municipal Offices, Lowther St. (See June 21 issue.)

July 12.—Truro. Complete installation of electricity in Regent Theatre. C. L. E. Stewart, Consulting Engineer, Court Rd., Newton Ferrers, Plymouth. Deposit £3 3s. (See June 21 issue.)

July 13.—Belfast. Supply and erection of automatic chlorinating plant at Harbour power station. Merz and McLellan, consulting engineers, Carliol House, Newcastle-on-Tyne 1. Deposit £5 5s. (See June 7 issue.)

July 13.—Malden and Coombe (Surrey) U.D.C. Supply and erection of 84 centrifugally spun concrete columns with 400 W mercury lanterns for Traps Lane and Coombe Lane. Borough Engineer, Municipal Offices, New Malden. (Advertised in this issue.)

July 14.—Macclesfield T.C. Supply and erection of 42 sodium lighting units on concrete columns for Hibel Rd., Gas Rd., Waters Green, and Sunderland St. T. H. Dossett, Borough Engineer, Town Hall. Deposit £2 2s. (Advertised in this issue.)

July 16.—Durham. Provision of six and erection of 23 steel columns, mercury discharge lanterns and fittings, Group A, in Quarryheads Lane. City Engineer, Town Hall. Deposit £2 2s. (See June 21 issue.)

July 16.—Swansea T.C. Electrical installation at Mayhill primary school. Applications by above date to Borough Architect, The Guildhall. Deposit £2. (Advertised in this issue.)

July 18.—Manchester. Electrical installation at City Training College, Long Millgate. City Architect, Town Hall. Deposit £1 1s. (See June 21 issue.)

July 19.—Halifax T.C. Re-electrification of the Ostler schools. Borough Engineer, Crossley St. Deposit £2 2s. (Advertised in this issue.)

July 21.—N. Ireland. Supply and installation of underground cable system and electrical switchgear at Whiteabbey Hospital for N.I. Tuberculosis Authority. Applications to W. Harvey, secretary, 27 Adelaide St., Belfast. Deposit £3 3s. in each case.

July 23.—Tees Valley Water Board. Heating installation at the low lift and high lift pumping stations and filtration buildings, Darlington (deposit £5 5s.), and supply and erection of electrically-driven centrifugal pumping plant at Long Newton (deposit £10 10s.). Separate contracts. Applications to T. S. R. Winter, Engineer and General Manager of Board, Corporation Rd., Middlesbrough.

July 30.—Newbiggin-by-the-Sea U.D.C. Provision and erection of 95 standards, lamps and auxiliary equipment on roads A 197, B 1334 and other streets in the district. H. Selby Robson, Engineer and Surveyor, Council Offices. Deposit £2 2s.

Aug. 2.—Swinton and Pendlebury T.C. Supply and erection of electrically driven centrifugal pump capable of 1,000 g.p.m. Borough Engineer and Surveyor, Town Hall, Swinton, Lancs.

Aug. 17.—Belfast. Supply and erection at Victoria power station of 3,300 V 150 MVA air or oil break switchgear, 400 V, 15 MVA air break switchgear, 400 V fuse gear and accessories. Also three centrifugal circulating water pumps each capable of 23,000 g.p.m. Merz and McLellan, consulting engineers, Carliol House, Newcastle-on-Tyne. Deposit £5 5s. for each specification. (See June 14 issue.)

Sept. 3.—Dublin. Electricity Supply Board invites tenders for supply, delivery and erection of one 30 MW steam-driven turbo-alternator set with condensing plant, feed heating plant and auxiliaries at Ringsend power station. Generation Engineer, 27 Lower Fitzwilliam St., Dublin. Deposit £5 5s. (See May 24 issue.)

No date stated.—Haddington T.C. Electrical installation in 38 houses on Caponflat site. Applications to John McVie, Town Clerk.

No date stated.—Middlesex. Applications invited by County Council from contractors who desire to be invited to tender for installation of electric lifts and electric lighting and power installations. County Architect, 10 Gt. George St., Westminster.

No date stated.—Aberdeen. Supply and erection of approx. 13 miles of single circuit, wood pole line between Strichen and Peterhead, for N. of Scotland H.E. Board. Merz and McLellan, 39 Northumberland St., Edinburgh 3. Deposit £1 1s.

No date stated.—Midlothian. Electrical work in erection of block of 4 houses at Pathhead. County Architect, 32 Palmerston Place, Edinburgh 12.

Your Queries — Answered

"Mitchell" mixers, makers of? B.T.—L. A. Mitchell, Ltd., 37 Peter St., Manchester 2. (20579)

"Fankuld" motors, makers of? T.E.—Lancashire Dynamo and Crypto (Mfg.) Ltd., Trafford Park, Manchester. (20587)

"Laybat" infra red chicken rearing lamps, makers of? N.E.—Clarbat Ltd., 302 Barrington Rd., S.W.9. (20595)

Waffle irons, makers of? N.E.—S.L.R. Electric Ltd., 58 South Harrow Viaduct, South Harrow, Middx., A.G. Field and Co., Ltd., 10 Devonshire Row, E.C.2. (20607)

Door locks, electric, makers of? W.W.—W. C. Davey and Co., 180 Tottenham Court Rd., W.1. Cox-Walker and Co., Ltd., Coxpar Works, Darlington. (20616)

The above are selected from questions we have answered this week. If you have a query, send it to us.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

July 6.—S. Rhodesia. Supply of 1,622 storage batteries, 80 6-8 V car batteries, and 30,000 torch batteries. Secretary, Tender Board, P.O. Box 75, Causeway.

July 26.—Melbourne. Supply and delivery of 21 items of insulated wire for Posts and Telegraphs, Melbourne. These to include jumper wire, screened wire, cable, switchboard wire, switch wire and bank multiple wire. Tenders may be sent to Chief Supply Officer, Room 406, Australia House, Strand, W.C.2.

Aug. 16.—Australia. Manufacture, testing and delivery of two 11 kV three-phase oil-immersed current limiting reactors, for Banksmeadow substation. Tenders invited by Sydney County Council. B.o.T. (Ref. CRE (IB) 68936/51).*

Sept. 11.—Wellington (N.Z.). Supply of eight 50 kV potential transformers each 28,900/63·5 V 500 VA for Tauranga and Waikino substations. Secretary, Tenders Committee, State Hydro-Electric Dept., Wellington. Deposit £75.

Feb. 15, 1952.—New Zealand. Dunedin Drainage and Sewerage Board has issued call for tenders for supply and delivery of pumping plant for Musselburgh Sewage Station. Specification includes four electric autosynchronous motors, starters, switchgear, spare parts, etc. Municipal Chambers, Dunedin. B.o.T. (Ref. CRE (IB) 63426/51).*

TRADE NOTES

B.E.A.M.A. Contract Price Adjustment Formulae. For purposes of calculating variations in: (a) "Rates of Pay"—the rate of pay for adult male labour at June 16 shall be deemed to be 120s.; (b) "Costs of Material"—the index figure for Intermediate Products last published by the Board of Trade on June 16, 1951, is 383·6 and is the figure for the month of May, 1951.

New Address. Having moved to larger premises 4 miles from the centre of Hereford, the new address of Barronia Metals (Gt. Britain) Ltd., is Clehonger, Hereford. Telephone: Belmont 287.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	234 0 0	£220 0 0
LEAD, good soft pig (foreign)	160 0 0	136 0 0
,, ,, ,, "English" quality ...	161 10 0	
TIN (99-99.75%) ... ...(Cash)	935-940	—
,, (3 months)	895-900	—
ALUMINIUM, commercial purity (del.)	124 0 0	—
ZINC	160 0 0	140 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	47 10 0	—
Mild Steel Tape (0·04 in.)	26 10 0	—

CONTRACTS PLACED

Bedford T.C. Street lighting installation in Ampthill Rd., London Rd., Kempston Rd., Cauldwell St., and Harrowden Rd., Revo Electrical Co. Ltd., £9,406.

Hull. Electrical installation in 60 three-storey flats in Anlaby Rd., A. Lee. Same in 40 houses in Bilton Grange estate, Reliance Electrical Co. and in Chiltern St. school, Booker and Tarran, Ltd.

Northampton. Electrical installation to 96 houses in course of erection, S. and E. Electrical, £3,054.

Romford T.C. Electrical installation in 114 houses and flats on Cross Rd. site, Mid-Essex Electrical Engineers, £2,468.

Rochdale T.C. Laying of approx. 2,850 yd. of cable for street lighting, M.R.Q. Construction Co.

Scarborough T.C. Installation of lift in Town Hall, Keighley Lifts Ltd., £1,108.

Seaham (Durham) U.D.C. Cable services and time switches for street lighting, N.E. Electricity Board, £1,441.

Stockton-on-Tees T.C. Installation of electricity in 50 houses on Roseworth estate, W. Stewart and Son, £1,388.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Manton's Electrics Ltd., of Cobham, Surrey, have appointed Jack Berliand, Burwood Oak, Burwood Park, Walton-on-Thames, as liquidator, and creditors are asked to send particulars to him by tomorrow (June 29).

British Electric Co. Ltd. Meeting of creditors to be held at offices of Lathan and Co., 185-188 High Holborn, W.C.1, tomorrow (Friday) at 11.30 a.m.

Electra Sales (Essex), Ltd. Meeting of creditors to be held at Winchester House, Old Broad St., E.C.2, on July 3, at 12 noon.

Voluntary Liquidation

Ranelagh Radio and Electrical Co., Ltd., Westbourne Grove, London W.2. At meeting of creditors liabilities shown amounting to £4,669. Assets estimated to produce £180, thus leaving deficiency, as regarded creditors, of £4,489. So far as the shareholders were concerned, there was a deficiency of £4,989. Resolution passed for the appointment of Mr. A. F. Attwood, 20-21 Lawrence Lane, E.C., as liquidator with committee of inspection.

BANKRUPTCY ACTS

Receiving Order

Kendal. Stephen Edmondson, electrical dealer and contractor, trading as "E. and B. Radio" at Main St., Milnthorpe. Date of receiving order, June 18.

Partnership Dissolved

Rugby. Herbert F. Thorrington and William Starkey, trading as "Thorrington and Starkey," electrical contractors, at Eydon, near Rugby. Partnership dissolved as from June 1, and business now being carried on by H. F. Thorrington alone.

Appointments of Liquidator

London. Lewker Products Ltd., dealers in electrical and radio apparatus at Deoda Rd., S.W.15, have appointed Donald F. Gay, 39-41 New Broad St., E.C.2, as liquidator, with committee of inspection.

Huddersfield. J. R. Dunkley and Co. Ltd., electrical contractors of Brook St. Richard Vivian Garton, 23 John William St., Huddersfield, has been appointed liquidator.

BUSINESS PROSPECTS

HOME

Aldershot T.C. Plans approved for erection of three blocks of flats in Whyte Ave., and two blocks of dwellings in Poole Rd. It is also proposed to build two other blocks of flats in Cambridge Rd.

Barking. Permission given for construction of head office and showrooms for Page, Calnan and Co. Ltd. at Town Quay Wharf. Architects are Tooley and Foster, Midland Bank Chambers, Buckhurst Hill. Estimated cost of project is over £25,000.

Barnes. Erection of a block of 15 flats at White Hart Lane. Borough Engineer and Surveyor, Municipal Offices, Sheen Lane, S.W.14.

Battersea. Extension to Patmore St. site includes three 6-storey blocks of flats with 5-storey wings, and a 4-storey block of flats, maisonettes and shops.

Bedford T.C. Negotiations in hand for building of 88 flats on Old Ford End site.

Belfast. Construction of 129 houses in Ballyclare Rd., Glengormley. Council Office, 51 Lisburn Rd., Belfast.

Bermondsey. Scheme approved for development of site in Jamaica Rd. by erection of 58 flats in three blocks at estimated cost of £117,000.

Brigg U.D.C. It has been proposed to wire 151 council houses for electricity at estimated cost of £3,397.

Brighton T.C. Construction of 62 houses on Bates Nursery site. Borough Engineer and Surveyor, 26-30 King's Rd.

Also tenders are being sought for new technical block and adaptation of Varndean secondary school. Estimated cost is £17,000. Education Officer, Marlborough House, Old Steine.

Bromsgrove U.D.C. 108 houses are to be built on Charford estate.

Co. Down. Construction of new county primary school at Lisnasharragh. Roe, Stevenson and Sons, Quantity Surveyors, 33 College Gardens, Belfast.

Cowbridge R.D.C. Site works have begun on Pantgwyn site, where it is proposed to build 300 houses. Council's Surveyor is W. R. Hawkins, The Druids, Cowbridge.

Darlington. Newcastle Regional Hospital Board proposes to modernise maternity hospital. Chief architect is P. H. Knighton.

East Suffolk. Building programme for 1952-3 includes schools at Woodbridge, Combs Ford and Reydon; extensions to schools at Holbrook, Bamford, Shortley and Bungay; additional classrooms for Felixstowe, Beccles and Framlington schools. Total estimated cost £328,997.

Essex. C.C. has approved the erection of 71 police houses at an estimated cost of £131,250.

Epping (Essex) R.D.C. Ten houses each to be built at Harlow, Nazeing, Sheering and North Weald.

Falkirk T.C. has approved construction of 100 houses for miners in the Bog Road area.

Grantham T.C. Council is to build 24 houses in Tennyson Ave. and 22 in Harrowby Lane.

Heston and Isleworth T.C. Erection of 6 shops and 8 flats on Hounslow West estate. O. P. F. Hilton, Borough Engineer and Surveyor, 88 Lampton Rd., Hounslow.

Ilkley U.D.C. Erection of 26 houses and 4 flats at Menston. A. Skinner, Surveyor, Chantry Drive, Ilkley.

Isle of Ely. County primary infants' school at Maple Grove, March, has been added to this year's building programme.

Kenilworth U.D.C. Erection of 40 houses on Bulkington estate. G. A. J. Edmundson, Surveyor, The Council House.

Leeds. Erection of approx. 200 dwellings on various estates. Applications to City Architect, Priestley House, Quarry Hill, Leeds 9.

Lisburn U.D.C. Construction of 46 houses on Greenwood estate. Town Surveyor, Town Hall.

Meriden R.D.C. Erection of 64 houses at Balsall. P. B. Herbert, Grosvenor Buildings, Steelhouse Lane, Birmingham 4.

Morpeth T.C. A further 50 houses are to be built in Spelvit Lane. Borough engineer is F. K. Perkins.

Newbury R.D.C. Erection of 78 houses at Thateham. Architect is E. G. V. Hives, 3 Cork St., Reading.

North Riding. Tenders being obtained for erection of infant welfare centre at Saltburn. County Architect, County Hall, Northallerton.

Norwich. It is proposed to build primary school in Wolfe Road.

Oswestry R.D.C. Tenders to be invited shortly for erection of 8 houses at Llanymynech, and plans approved for 6 at Kinnerley.

Nottingham. Tenders required for erection of technical college estimated to cost about £50,000. F. Stephenson, Clerk to Joint Education Committee, Education Office, South Parade.

Oxhey (Herts). A scheme for development of site off Watford Rd. involves erection of 110 houses at an estimated cost of £339,115.

Portsmouth. Council recommended to approve plans for 20 flats and 16 bungalows for old people at Landport.

Romford T.C. It is proposed to build secondary school in Boxhill Road.

Ripon and Pateley Bridge R.D.C. Erection of 40 houses and 5 bungalows at Pateley Bridge. Council's Architect is J. C. Kenyon.

Sheffield. Erection of The Brook secondary modern school off Richmond Rd. W. George Davies, City Architect, Town Hall.

Skipton U.D.C. Construction of 50 houses on Horse Close estate. Engineer and Surveyor, K. B. Robinson, Town Hall.

Spalding (Lincs) U.D.C. Erection of 34 houses on St. Paul's estate. Office of Surveyor, Short St.

Sunderland T.C. Offices for the Entertainments Dept. are to be built at Seaburn at a cost of £6,000. Plans are by Borough Architect, H. C. Bishop, Grange House, Stockton Rd.

Thornaby-on-Tees. T. Rae, builder of Ackham Terrace, Thornaby, is planning erection of 13 houses in Humber Rd. and 26 in Clarendon Rd.

Washington (Durham) U.D.C. Application made for sanction to borrow £64,077 for erection of 50 houses in Blue House Lane and £22,302 for a further 18 houses.

Watford T.C. Plans approved for construction of 78 dwellings for old people at Abbots Langley.

Wem (Salop) R.D.C. Construction of 24 houses at Shawbury. Townsend and Renandon, quantity surveyors, 40-42 Stoke Rd., Shelton, Stoke-on-Trent.

Wisbech (Isle of Ely). Scheme approved for first instalment of College for Further Education

(continued overleaf)

Business Prospects continued—

and Technical Institute in Rammoth Rd. Estimated cost, £80,000.

Woolwich. Adie, Bulton and Partners are architects for development of Milne estate by erection of 157 flats in 10 blocks.

OVERSEAS

Canada. Messrs. Highway Paving Co., Ltd., 6301 Park Ave., Montreal, want to purchase from the U.K. two 250 h.p. v/l water tube type boilers, continuous steam capacity 1,400 lb p.h. and working pressure 125 lb per sq in. The 2-hr overload capacity must be stated. Quotations to firm direct for attention of Mr. F. Potts.

Also Fleming-Pedlar Ltd., 166 Osborne St., Winnipeg, want to contact U.K. suppliers of oil heating equipment suitable for domestic and industrial purposes.

India. Representatives of two Bombay firms, now in England, are anxious to contact manufacturers of electrical equipment. They are Mr. Chiminlal B. Shah and Mr. Shantilal V. Sheth, both of Shantilal and Bros., 54 Lohar St., who can be contacted c/o American Express Co., 6 Haymarket, and Mr. S. B. Sheth of V. S. Roy and Co., 185 Lohar Charl, who is staying at National Hotel, Russell Square, W.C.2.

Messrs. Jhangianis Ltd., Bombay Mutual Annexe Gunbow St., Fort, Bombay, would like to procure agencies for electrical goods and machinery. Interested companies should contact Mr. B. J. Jhangiani at 8 Willow Bridge Rd., Canonbury, N.1.

Also Messrs. Kapuria Bros., P.O. Box 62, Connaught Place, New Delhi, wish to import heavy and light machinery, electric motors and generators, diesel engines, electrical goods and motor accessories.

France. M. C. H. Testuz, 30 Avenue de Messine, Paris, is interested in obtaining further agencies. He is now interested in mechanical and electrical equipment for ships, mines, electricity production and heavy industry. Contact should be made at above address.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Butcher and Son (Electrical) Ltd., 81 High St., Dunmow, Essex. Elec. engrs., etc. Cap.: £5,000. Dirs.: S. G. Hopkins and Mrs. B. I. Hopkins, and J. G. Shergold.

Oldbury Automatic Plating Co., Ltd., 8 Simpson St., Oldbury. To take over business of an automatic electro-plater carried on at Oldbury by John Round. Cap.: £7,000. Dirs.: J. Round and A. S. Lees.

Lowacost (Light), Ltd. Offices of Alfred Bieber and Bieber, 1 Broad St. Place, E.C.2. Lighting, elec., wireless and genl. engrs., etc. Cap.: £1,000. Dirs.: A. Bieber.

Regional Air Trading Co., Ltd. Genl., aero, marine, elec. and radio engrs., etc. Cap.: £100. Dirs.: A. Humphrey, Mrs. F. M. Humphrey, and Mrs. P. Humphrey.

T.D. Developments, Ltd., 7 Gt. Castle St., W.1. Mnfrs. of and dlrs. in electro-mechanical devices, mech. engrs., etc. Cap.: £1,000. Dirs.: W. T. Marchment, D. A. Wilkinson, and Constance L. Marchment.

W. Partington (Whitefield), Ltd., 1a Radcliffe New Rd., Whitefield, nr. Manchester. To take over business of a plumber and electrician carried on at Whitefield by William Partington. Cap.: £1,000. Dirs.: Mrs. L. Partington and J. A. G. Goddard.

Alkasol, Ltd., Old Bank Bldgs., High St., Rotherham. Mnfrs. of and dlrs. in Electrolite of all kinds, batteries, accumulators, etc. Cap.: £100. Dirs.: A. Elliott and A. H. Travis.

General Electrical Services (West Wales) Ltd., "Westfa," Alexandra Rd., Gorseinon, Swansea. Maintainers, servicers and manufacturers of and dealers in automobile accessories, etc. Cap.: £3,000. Dirs.: T. L. Lewis, F. G. Bevis and D. M. Jenkins.

Sussex Armature Rewinds Ltd., 4 Conway Pl., Hove 3. Cap.: £2,000. Permanent dirs.: L. L. Sago, D. G. E. Collins and W. G. Hinde.

Sidney Benn, Ltd., 25 Brinkworth Rd., Ilford. Mech., elec., consultant, research and gen. engrs., etc. Cap.: £1,000. Dirs.: S. Benn and S. L. Benn.

West London Appliances Ltd., 1a Church Av., East Sheen, S.W.14. Manufacturers of and dealers in gas, water, electric and general requisites and appliances, etc. Cap.: £100. Dirs.: C. A. Turner and H. W. Petherick.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Beacon, with design. 693,978. Class 7. Electricity generators, electric motors and starters, air compressors, pumps, etc. Workman, Reed and Co., Ltd., Beacon Works, Hewish, near Bristol.

Bound Brook Bearings (G.B.) Ltd., with design. 691,948. Class 9. Parts of scientific, nautical surveying and electrical apparatus and instruments, etc., all being goods of common metal. 691,949. Class 11. Parts of installations for lighting, heating, steam generation, cooking, etc., being goods of common metal. Bound Brook Bearings (G.B.) Ltd., Trent Valley Trading Estate, Trent Valley Rd., Lichfield, Staffs.

Cinetone. 693,278. Class 9. Cinematograph projector equipment. Cinetone Equipment Co., Ltd., 317 Euston Rd., N.W.1.

Fluorostat. B692,699 and **Fluorostatic.** B692,700. Class 11. Fluoroscent lighting apparatus. C.A.V. Ltd., Warple Way, Acton, W.3.

Twinlay. B694,455. Class 17. Insulating and identification sleeves made of polyoinyl chloride plastics. Hellerman Electric Ltd., Tinsley Lane, Crawley, Sussex.

MEETINGS TO NOTE

TUESDAY, JULY 3

I.E.E. (N. Midland Students' Section).—Summer meeting. "Selection and Development of Power Station Sites," W. H. Dunkley. Lighting Service Bureau, Aire St., Leeds, 6.30 p.m.

WEDNESDAY, JULY 4

A.S.E.E. (N. London Branch).—"The Camera and the Engineer." G. E. Whalley. Three Jolly Butchers Hotel, Wood Green, N.22, 8.12 p.m.

INSTRUMENT INDUSTRIES EXHIBITION. Opens at National Hall, Olympia, London, continuing until July 14.

WELSH INDUSTRIES FAIR at Cardiff until July 14.

THURSDAY, JULY 5

FESTIVAL SHIP "CAMPANIA" arrives at Plymouth, remaining until July 14.

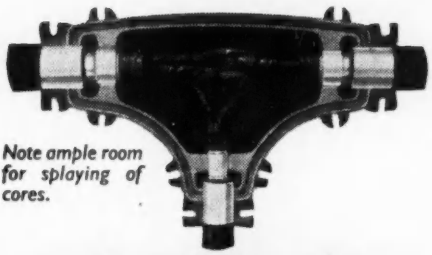
THURSDAY, JULY 12

INCORP. PLANT ENGRS. (Newcastle Branch).—"Oil in Industry." I. A. Howden of Shell-Mex and B.P. Ltd., 8 Oxford St., 7.30 p.m.

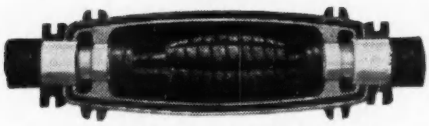
FRIDAY, JULY 13

E.I.B.A.—Annual meeting and council at I.E.E., Savoy Place, W.C.2, 11.30 a.m.

BOXES YOU CAN BURY AND FORGET



Note ample room for splaying of cores.



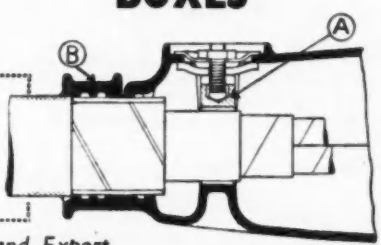
Completed Multicore Joint (above) and Box with top half in position (below).

The design of HENLEY "Cablegrip" type Boxes is based on years of experience of practical jointing conditions, and incorporates all those features which facilitate jointing operations. Their complete reliability bears out our claim for these boxes—that you can "*bury and forget.*"

The range of "Cablegrip" type boxes include Straight Through, Service and Branch Boxes for underground installation. The "Cablegrip" gland and armour clamp, which is a feature of the boxes, is illustrated below.

HENLEY

"CABLEGRIP" STRAIGHT THROUGH SERVICE & BRANCH BOXES

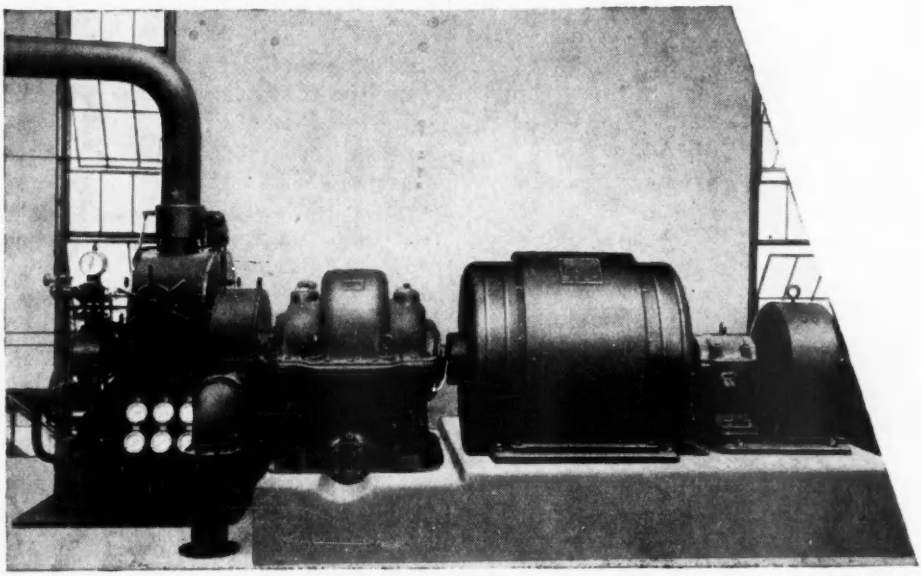


The "Cablegrip" gland and armour clamp provides two wide bearings for the cable. A highly efficient bond to the lead sheathing is effected by means of a cast iron shuttle (A) and to the armouring by means of a cast iron armour clamp (B).

Available for Home and Export.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51—53, HATTON GARDEN, LONDON, E·C·1

Back pressure TURBINES



for the chemical industry

The photograph shows a 750 kW back pressure geared turbo-generator installed in South America; it is typical of many such sets in world-wide use. Similar machines with outputs ranging from 100 kW to 2,000 kW are in service in chemical works, dyeworks, mines, hospitals, and sugar refineries: others are installed in generating stations for power supply to auxiliaries, for pump drives, and for district heating.

Larger direct-coupled back pressure turbo-generators with outputs up to 30,000 kW and for initial steam conditions up to 1,900 psig. and 950°F. have been manufactured for industrial undertakings requiring their own electric power supply and large quantities of process steam, and for operation in conjunction with condensing turbines.

METROPOLITAN-VICKERS ELECTRICAL CO. LTD.
MANCHESTER, 17, ENGLAND

Member of the A.E.I. group of companies

METROVICK *steam or gas turbines, condensers & auxiliaries*

B/L101

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., London, W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. 0d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BOROUCH OF MACCLESFIELD

Class "A" Street Lighting

HIBEL ROAD, GAS ROAD, WATERS GREEN AND SUNDERLAND STREET

TENDERS are invited for the supply and erection of 42 sodium lighting units mounted on pre-cast concrete columns.

Plans and conditions of contract may be seen and specification and form of tender obtained from Mr. J. H. Dossett, A.M.I.C.E., Borough Engineer, Town Hall, Macclesfield, on payment of a deposit of £2 2s., to be returned on receipt of a bona fide tender together with all documents.

Tenders, in plain sealed envelope endorsed "Street Lighting," must be delivered to the undersigned not later than noon on Saturday, July 14, 1951.

The Council do not bind themselves to accept the lowest or any tender.

WALTER ISAAC,
Town Clerk.

Town Hall, Macclesfield.
June 19, 1951. (L 209)

BOROUGH OF MALDEN AND COOMBE

STREET LIGHTING—TRAPS LANE AND COOMBE LANE

TENDERS are invited for the supply and erection of 84 centrifugally spun concrete lamp columns, 25 ft. high, with 400 watt mercury vapour lanterns.

The form of tender, specification and bill of quantities may be obtained by written application to the Borough Engineer, Municipal Offices, New Malden, Surrey. Tenders, enclosed in envelopes to be supplied by the Council, should reach the undersigned not later than noon on July 13, 1951.

The Council does not bind itself to accept the lowest or any tender.

HAROLD E. BARRETT,
Town Clerk.

Municipal Offices,
New Malden Surrey.
June, 1951. (L 271)

BOROUGH OF BECKENHAM

THE Council invite tenders for the supply (only) of 125·2 kW Convector Heaters. An outlined specification of the Council's requirements can be obtained on application from the Borough Engineer, Town Hall, Beckenham, Kent.

Sealed tenders, in the plain, official envelope provided, endorsed "Tender for Convector Heaters," must reach the undersigned not later than 5 p.m. on Friday, July 6, 1951. Tenders received after the prescribed date and time will not be considered.

The Council does not bind itself to accept the lowest or any tender.

C. ERIC STADDON,
Town Clerk.

Town Hall,
Beckenham, Kent. (L 239)

BINGLEY URBAN DISTRICT COUNCIL

STREET LIGHTING INSTALLATION—COTTINGLEY HOUSING SITE

TENDERS are invited for the supply, erection and installation of 28 street lighting columns, lanterns and auxiliary equipment for the above scheme.

Drawings may be seen, and specification, bill of quantities and form of tender obtained from J. S. Lattin, M.I.Mun.E., A.M.T.P.I., Engineer and Surveyor, Town Hall, Bingley, upon payment of a deposit of two guineas, which will be returned on receipt of a bona fide tender not

(*Continued in next column*)

(*Continued from previous column*)

subsequently withdrawn. Cheques to be made payable to Bingley Urban District Council.

Tenders, in sealed envelopes endorsed "Street Lighting —Cottingley Housing Site," and not bearing any mark indicating the sender, must be received by the undersigned not later than noon on Monday, July 9, 1951.

The Council do not bind themselves to accept the lowest or any tender.

F. M. DUNWELL,
Clerk of the Council.

Town Hall, Bingley, Yorks. (L 208)

COUNTY BOROUGH OF SWANSEA

Mayhill Primary School, Mayhill, Swansea

TENDERS FOR ELECTRICAL INSTALLATION

FIRMS wishing to tender for the Electrical Installation at the Mayhill Primary School now in course of erection at Mayhill, Swansea, are invited to submit their applications to the Borough Architect, The Guildhall, Swansea, on or before Monday, July 16, 1951.

Plans, specifications and conditions of contract can be obtained on application and deposit of £2, provided the applicant gives satisfactory evidence of having previously carried out work of a similar character. The deposit will be refunded after delivery of a bona fide tender (which is not subsequently withdrawn) and the return of all documents.

No guarantee is given that the lowest or any other tender will be accepted.

T. B. BOWEN,
Town Clerk.
(L 266)

COUNTY BOROUGH OF HALIFAX

Education Committee

RE-ELECTRIFICATION OF OSTLER SCHOOLS, HALIFAX

TENDERS are invited for the re-electrification of the above existing Secondary and Primary Schools.

Plans, specification, schedules and form of tender may be obtained at the office of the Borough Engineer, Crossley Street, Halifax, on the payment of a deposit of £2 2s. (cheques made payable to 'Halifax Corporation') which will be returned after receipt of a bona fide tender.

Sealed tenders endorsed "Tender for Electrical Work—Ostler Schools" must be delivered to the undersigned not later than Thursday, July 19, 1951.

The Committee does not bind itself to accept the lowest or any tender.

RICHARD de Z. HALL,
Town Clerk.

Town Hall, Halifax.
June 22, 1951. (L 272)

APPOINTMENTS VACANT

SOUTHERN RHODESIA GOVERNMENT

VACANCIES: TELEPHONE TECHNICIANS

APPLICATIONS are invited from fully-qualified telephone technicians aged 21 to 40 with at least 8 years' practical experience in telecommunications industry or similar service. Appointments on 3-year contract with possibility of renewal for further period. Rate of pay: £55 per mensem plus C.O.L. allowance at present £19 13s. 4d. per mensem. Children's allowances also payable.

Travelling fare will be provided from U.K. to Southern Rhodesia for successful applicants.

Forms and further information from Secretary to the High Commissioner for Southern Rhodesia, 429 Strand, London W.C.2, to whom completed forms should be returned not later than July 28, 1951.

Canvassing will disqualify applicants. (L 210)

COMMONWEALTH TECHNICAL CO-OPERATION SCHEME

APPLICATIONS are invited by the Commonwealth Relations Office for the post of EXPERT DESIGNING ENGINEER under the Government of India, in India, at a salary of £3,000 to £3,500 per annum, plus subsistence allowance, travelling facilities and free medical attention. Other facilities, including those for families, to be discussed. Applicants, preferably between the ages of 45 and 50, should be corporate members of the Institution of Civil, Mechanical or Electrical Engineers, and must have considerable experience in the design of extra high tension transmission lines, including tower structures. The selected applicant will be responsible to the Chairman, Central Waterpower, Irrigation and Navigation Commission, for the mechanical and electrical design of such transmission systems as will be required for grid supply connecting super-hydro power stations and long-distance power transmission projects. He will be expected to guide and train the Indian engineers under his control. The contract is for two years in the first instance. Forms of application may be obtained from the Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, W.C.2, quoting D280/51/A.O. Closing date, July 28, 1951. (L 246)

BRITISH ELECTRICITY AUTHORITY

London Division

BOILER HOUSE ENGINEER—BATTERSEA GENERATING STATION

APPLICATIONS are invited for the above position from candidates who have received a sound practical and technical training in mechanical engineering, steam generation and the combustion of fuel. Previous experience in charge of large steam generating units is essential and experience with pulverised fuel firing is desirable.

The successful candidate will be required to take charge of a shift operating the steam generating and associated plant in Battersea "A" and "B" Stations.

The position is superannuable.

Salary will be in accordance with the revised N.J.B. Schedule, Class "L," Grade 9,, plus London Allowance, £776/10/- p.a.

Applications, stating age, qualifications and enclosing copies of testimonials, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, S.W.1, within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(L 188)

LONDON TRANSPORT EXECUTIVE

INVITE applications from CHEMISTS for a vacancy in its Laboratory Service. The successful candidate will be in immediate day-to-day charge of a power station laboratory in the N.W. or S.W. area of London. The activities of these laboratories are co-ordinated under a senior chemist. Applicants must possess a degree, or an equivalent qualification. Possession of an Honours degree would be an advantage. Industrial experience in the examination of solid and liquid fuels and in the treatment of boiler feed water, together with analytical control of water treatment processes, is essential.

The salary range for the post is £650 per annum rising by annual increments of £20 to £750 per annum, with prospects of further advancement. The appointment is subject to a medical examination. On completion of a satisfactory probationary period, the selected applicant will be expected to join a contributory superannuation scheme.

Applications, giving full details of age, training, experience and present salary should be sent within 14 days of the appearance of this advertisement to the Staff Officer, (F EV. 180), London Transport Executive, 55 Broadway, Westminster, London S.W.1. For acknowledgement, enclose addressed envelope. (L 231)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointment:—

No. 5 (Wakefield) Sub-Area

DRAUGHTSMAN

(Vacancy No. 79/51)

Applicants should have a knowledge of the theory and principles applicable to the design, layout and construction of civil, mechanical and electrical plant and equipment, site surveys, etc., and be able to work to instructions on general work of this nature and in the building up of modifications using existing designs. Salary, £375 to £500 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, within fourteen days of the appearance of this advertisement. (L 249)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment in the Transmission Department at Divisional Headquarters:—

ASSISTANT SECTION ENGINEER.

Salary in accordance with the National Joint Board Agreement, Schedule 'C', Grade 6, Class AX/CX (£516-£686 per annum plus London Weighting).

The commencing salary will depend upon qualifications and experience.

Applicants should preferably hold corporate or graduate membership of the I.E.E. or equivalent qualifications and should have had experience in the construction or operation and maintenance of high voltage overhead lines, cables and substation equipment up to 132 kV.

The appointment will be Superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than July 14, 1951. Envelopes should be endorsed "Assistant Section Engineer—Transmission."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (L 236)

BRITISH ELECTRICITY AUTHORITY

London Division

JUNIOR ENGINEERS—WEST HAM, STEPNEY AND BANKSIDE GENERATING STATIONS

CANDIDATES should have received a sound technical training and preferably had some practical experience of generating station plant. These positions will offer full opportunity for complete generating station training and operational duties.

Salaries and conditions of service for these positions, which are superannuable, will be in accordance with the N.J.B. Agreement, Schedule "A."

West Ham: Class "G," Grade 14, i.e. £437 p.a. inclusive of London Allowance.

Stepney and Bankside: Class "F," Grade 14, i.e. £417 p.a. inclusive of London Allowance.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1.

J. N. WAITE,
Divisional Controller.
(L 189)

BRITISH ELECTRICITY AUTHORITY

South East Scotland Divison

OPERATION AND EFFICIENCY ENGINEER

APPLICATIONS are invited for the appointment of an Operation and Efficiency Engineer at Bonnybridge Power Station, Stirlingshire, on Grade 5, Class "F" National Joint Board Agreement, salary range £711-£737.

Conditions of service will be in accordance with the National Joint Board Agreement. The appointment is superannuable.

Applicants should have received a sound technical education and should have previous experience in the operation and maintenance of steam electric plant. A knowledge of high tension switchgear is essential.

Applications, stating age and experience, should be submitted to the undersigned by July 7, 1951.

J. F. FIELD,
Divisional Controller.

British Electricity House,
Portobello, Midlothian. (L 265)

BRITISH ELECTRICITY AUTHORITY

North-Western Division

APPLICATIONS are invited for the following positions:—

No. 485. ASSISTANT SHIFT CHARGE ENGINEER at the Stuart Street Generating Station, Bradford Manchester 11. The salary for this position, which is superannuable, will be £609 to £633 in accordance with Grade 9, Class "H" of the National Joint Board Agreement.

No. 488. STATION SHIFT CONTROL ENGINEER at the Westwood Generating Station, Wigan. The salary for this position, which is superannuable, will be £539 to £561, in accordance with Grade 10, Class "G" of the National Joint Board Agreement.

Candidates should preferably possess technical qualifications, and previous experience in a generating station is essential.

Applications, quoting vacancy number, stating age, qualifications, experience and present position, should be received by the Establishment Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester 20, not later than July 7, 1951. (L 248)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the under-mentioned appointments at Divisional Headquarters, Woolton, Liverpool.

(a) JUNIOR ENGINEERS—Salary Class "AX." Grade 9, £375-£505 per annum.

(b) GENERAL ASSISTANT ENGINEERS—Salary Class "AX." Grade 8, £437-£533 per annum.

Applicants for (a) should have a good general and technical education and possess the Higher National Certificate in engineering or equivalent qualifications.

Applicants for (b) should have a good general and technical education and possess a degree in engineering or equivalent qualifications. Practical experience in the construction or operation of a modern power station or substation and experience in a manufacturers works will be an advantage.

All appointments will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards' Superannuation scheme.

Forms of application may be obtained from the Divisional Secretary, Clarke Gardens, Woolton, Liverpool, and should be returned not later than Friday, July 20, 1951. (L 264)

CROWN AGENTS FOR THE COLONIES

ELECTRICAL ENGINEER (MECHANICAL) required by the Central Electricity Board, Federation of Malaya for 3 years with prospect of permanency. Salary (including expatriation pay) payable in local currency, equivalent at the present Government rate of exchange to £742 a year rising to £1,652 a year. Commencing salary according to age and experience. Cost of living allowance equivalent to between £336 and £707 a year according to salary and dependents. Free passages. Liberal leave on full salary. Candidates between 24 and 35 years of age must have had a good general education and be corporate members or graduates of the Institutions of Electrical or Mechanical Engineers or possess equivalent qualifications, and have had sound training in both electrical and mechanical engineering with experience in the operation and maintenance of Diesel-alternator generating plant of up to 1,000 kW units. Experience in an electricity supply undertaking would be a distinct advantage.

Apply, at once, by letter, stating age, full names in block letters and full particulars of qualifications and experience and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London S.W.1, quoting M.28370B on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (L 232)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the position of BOILER-HOUSE SHIFT CHARGE ENGINEER at Earley Generating Station.

Applicants must have had a sound technical training and be experienced in all branches of engineering associated with the operation of pulverised fuel-fired H.P. boiler plant, and have considerable knowledge of combustion and boiler chemistry. Graduate membership of the Institution of Mechnical or Electrical Engineers will be a strong recommendation.

The salary will be in accordance with Grade 9, Class "G," of the National Joint Board Schedule, at present £571-£597 per annum.

Application forms may be obtained from the undersigned, and should be returned not later than July 13, 1951.

P. D. A. OLIVER,
Divisional Secretary.

British Electricity House,
High Street, Portsmouth. (L 268)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of: FIRST ASSISTANT DISTRICT ENGINEER (Senior Section Engineer) in the Northwich District of the Board's No. 2 Sub-Area at a salary in accordance with N.J.B. Grade 4, Class "E," £722-£752 per annum.

Applicants should have the technical qualifications necessary to enable them to become Chartered Electrical Engineers and must have had considerable experience in H.T. and L.T. overhead and underground distribution work.

The appointment will be superannuable and subject to medical examination.

Applications, on forms obtainable from the Manager, No. 2 Sub-Area of the Board, Sandiway House, Near Northwich, Cheshire, should be completed and returned so as to be received not later than July 12, 1951.

JAMES RANKIN,
Secretary.
(L 261)

BRITISH ELECTRICITY AUTHORITY

South Western Division

STATION SHIFT CONTROL ENGINEER—NEWTON ABBOT GENERATING STATION

APPLICATIONS are invited for the position of Station Shift Control Engineer at Newton Abbot Generating Station.

Applicants should possess good technical qualifications and have had sound technical training and practical experience in the control and operation of steam generating plant and main switchgear.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class 'F', Grade 10, £510-£530 per annum.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, qualifications, experience, present appointment and salary should be addressed to the Divisional Secretary, British Electricity Authority, South Western Division, British Electricity House, 26 Oakfield Road, Bristol 8, so as to be received not later than July 7, 1951.

R. C. BARRETT,
Divisional Secretary.
June 20, 1951. (L 233)

BRITISH ELECTRICITY AUTHORITY

(a) JUNIOR ENGINEER (Control)—Littlebrook Power Station. Applicants should have had suitable training and experience in the operation of e.h.t. switchgear and parallel running of alternators.

(b) ASSISTANT ENGINEER (Mechanical)—Croydon "B" Power Station. Responsible for the planning of mechanical plant maintenance and associated labour. Practical experience of Power Station layout, operation and maintenance essential.

(c) GENERAL ASSISTANT ENGINEER (Transmission). To take charge of gang of fitters engaged on major overhauls in 132 kV substations. Applicants should have had the training and experience to enable them to organise and supervise this type of work. N.J.B. conditions of service and salary for all positions. (a) Class "J" between Grades 18 and 14, commencing at £400 per annum, (b) Class "J" Grade 11, £597 9s. 0d. per annum, (c) Class "AX." Grade 8, £462 per annum. Salaries quoted include London Allowance. Applications on forms obtainable from Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-on-Thames, to be received by July 7, 1951. (L 240)

BRITISH ELECTRICITY AUTHORITY

London Division

SHIFT CHARGE ENGINEER—FULHAM GENERATING STATION

APPLICATIONS are invited from candidates who have had technical education up to Higher National Certificate standard, including thermo-dynamics as a subject, together with a good general education. Considerable experience in the operation of a large modern Power Station is essential. Character and ability to deal with staff problems is important.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, Class 'E', Grade 7 (£825 6s. per annum, including London Allowance).

The position is superannuable.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, S.W.1, and be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(L 234)

BRITISH ELECTRICITY AUTHORITY

Chief Engineer's Department

SENIOR DRAUGHTSMEN, DRAUGHTSMEN, TRACERS

APPLICATIONS are invited for the following vacancies in the Drawing Office at Headquarters in London:—

SENIOR DRAUGHTSMEN and DRAUGHTSMEN with experience in (a) Power Station Layout and Plant in connection therewith, or (b) Civil Engineering or Building details.

TRACERS with experience in the above or General Engineering work.

Salaries will be in accordance with age and experience within the following ranges, which include London Allowance: Senior Draughtsmen, Grade 4, £630-£735 p.a.; Grade 5, £525-£630 p.a. Draughtsmen, Grade 6, £400-£525 p.a. Tracers, £123 p.a. at 16, rising to a maximum of £338 p.a.

The appointments are superannuable.

Application forms may be obtained from the Secretary's Office (Establishments), Applications Section, British Electricity Authority, British Electricity House, Great Portland Street, London W.1, and should be completed and returned to D. Moffat, Director of Establishments, at the above address, not later than July 13, 1951.

Please quote Reference AE/182. (L 230)

AIR MINISTRY

APPLICATIONS are invited for non-pensionable appointments as STATION ENGINEERS in the Directorate-General of Works at R.A.F. Stations.

The salary rises to a maximum of £560 per annum, and starting pay depends upon age, experience and qualifications. Annual increases will be granted for satisfactory service where salary is below the maximum.

Candidates, who should be natural-born British subjects, should have suitable practical experience and possess the following qualifications:—

(a) Ordinary National Certificate in Electrical Engineering or show that they have reached an equivalent standard of technical education;
(b) have served a recognised apprenticeship in electrical engineering with a firm or establishment of good repute;
(c) have had three years employment in electrical engineering, preferably on the operation and maintenance of mine, factory or workshop plant and services.

Preference will be given to applicants who, subsequent to (b) and (c), have had experience of supervising staff.

The work consists of the installation, operation and maintenance of high or medium voltage electrical distribution systems, electrical installations, steam and hot water heating systems and miscellaneous works plant, tools and equipment.

Applicants should state if, in addition to experience on above work, they have had responsibility for the maintenance and operation of Diesel-engined generating plant.

Appointments to locations at or nearest to those specified in applications will be arranged as far as possible.

Applications, stating age, qualifications and all previous appointments (with dates), to be addressed to the Air Ministry Directorate-General of Works (W.9), Bush House (S.E. Wing), Strand, W.C.2. (L 247)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Transmission Department at Divisional Headquarters:—

GENERAL ASSISTANT ENGINEERS (Construction and Maintenance Sections).

Salary in accordance with the National Joint Board Agreement, Schedule "C," Grade 8, Class AX/CX, (£437–£604 per annum plus London Weighting).

The commencing salary will depend upon qualifications and experience.

Applicants should possess a Higher National Certificate in Electrical Engineering and preference will be given to those who have had experience in the manufacture and construction or operation and maintenance of high voltage equipment.

The appointments will be Superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than July 14, 1951. Envelopes should be endorsed "General Assistant Engineers (Construction and Maintenance Section)—Transmission."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (L 235)

CITY OF COVENTRY

APPLICATIONS are invited for the following appointments in the Lighting Section of the City Engineer's Department.

(1) SENIOR ASSISTANT LIGHTING ENGINEER, Grade IV—£530/£575.

(2) JUNIOR TRAINEE (GENERAL DIVISION). Salary rising to maximum £425 at age 30.

Applicants for (1) must be capable Draughtsmen with experience in the preparation of schemes, specifications and estimates for all classes of public lighting, and have had at least 2 years experience of general routine practice and maintenance by direct labour. Preference will be given to persons who have some knowledge of electrical installation work and hold the Higher National Certificate in Electrical Engineering.

For (2) preference will be given to persons already employed in the electrical industry who are studying for an engineering course as approved by the Institution of Electrical Engineers.

All applicants are expected to become members of an appropriate organisation as referred to in paragraph 44 of the Charter.

Form of application and conditions of appointment may be obtained from the undersigned and must be returned not later than Tuesday, July 10, 1951.

GRANVILLE BERRY, M.Inst.C.E., M.Inst.Mun.E.,
City Engineer and Surveyor.

Council House, Coventry. (L 267)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Construction Section of the Transmission Department at Divisional Headquarters:—

(A) THIRD ASSISTANT ENGINEER (Electrical).
(B) THIRD ASSISTANT ENGINEER (Civil and Mechanical).

Salaries in accordance with the National Joint Board Agreement, Schedule "C," Grade 5, Class AX/CX, (£579–£753 per annum plus London Weighting).

Applicants for appointment (A) should have served an apprenticeship and should possess the Higher National Certificate in Electrical or Mechanical Engineering or its equivalent. They should have had experience in the installation of high voltage switchgear and the erection of transformers and the laying and joining of cables. Experience in the interpretation of specifications, the scrutiny of drawings, and dealing with correspondence will be an advantage. Corporate membership or Graduate membership of the Institution of Electrical Engineers is desirable.

Applicants for appointment (B) should have received theoretical and practical training in Civil and/or Mechanical Engineering and preferably should have passed either Parts A and B of the examination for Associate Membership of the Institution of Civil Engineers or the Graduate Membership Examination of the Institution of Mechanical Engineers or hold qualifications exempting therefrom, and should have had experience in the design and setting out of Site works, foundations for buildings and heavy plant, and also in the construction of electrical transmission lines erected on lattice steel towers. Experience in the interpretation of specifications, the scrutiny of drawings and in dealing with correspondence is desirable.

The appointments will be Superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than July 14, 1951. Envelopes should be endorsed with the appointment sought.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (L 237)

BRITISH ELECTRICITY AUTHORITY

London Division

DEPUTY STATION SUPERINTENDENT
WOOLWICH GENERATING STATION

APPLICATIONS are invited from candidates who have received a sound technical and practical training in electrical and mechanical engineering, followed by a wide experience in the operation and maintenance of a medium or large generating station.

Salary and conditions of service for this position, which is superannuable, will be in accordance with N.J.B. Schedule "A," Class "G," Grade 3, i.e. £929/5/- p.a. inclusive of London allowance.

ASSISTANT INSTRUMENT ENGINEER
FULHAM GENERATING STATION

Applications are invited from candidates who have served an apprenticeship at the works of an instrument manufacturer and who should be educated to at least Ordinary National Certificate standard. Preference will be given to candidates with some experience in instrument testing and calibrating for generating station work.

Salary for this position, which is superannuable, will be in accordance with N.J.B Agreement, Schedule "A" Class "K," Grade 13, i.e. £540/15/- p.a., and is subject to approval by the National Joint Board.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(L 187)

DERBY TECHNICAL COLLEGE

Normanton Road, Derby

APPLICATIONS are invited for the post of an ASSISTANT B in the Mathematics Department. Applicants should be graduates of a British university; a knowledge and interest in statistics would be an asset. Duties to commence in September, 1951, or as soon after as possible.

Further particulars and forms of application may be obtained from the undersigned, to whom they should be returned within 14 days of the appearance of this advertisement.

W. ALFRED RICHARDSON,
Principal.
(L 183)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the undermentioned appointments within the London Division.

Candidates should have received a sound engineering and technical training and have reached a recognised standard. Practical experience in the operation of power station plant is essential.

The conditions of service relating to these positions, which are superannuable, will be in accordance with N.J.B. Agreement.

ASSISTANT SHIFT CHARGE ENGINEER—Fulham Generating Station. Salary: Class "K," Grade 9, £721/7 per annum.

SHIFT CHARGE ENGINEER—Acton Lane Generating Station. Salary: Class "H," Grade 7, £726/12/- per annum.

ASSISTANT SHIFT CHARGE ENGINEER—Acton Lane Generating Station. Salary: Class "H," Grade 9, £639/9/- per annum.

BOILER HOUSE SHIFT CHARGE ENGINEER—Taylors Lane Generating Station. Salary: Class "F," Grade 9, £564/18/- per annum.

BOILER HOUSE SHIFT CHARGE ENGINEER—Battersea Generating Station. Salary: Class "K," Grade 9, £721/7/- per annum.

SHIFT CHARGE ENGINEER—Deptford West Generating Station. Salary: Class "J," Grade 7, £772/16/- per annum.

BOILER HOUSE SHIFT CHARGE ENGINEER—Deptford East Generating Station. Salary: Class "H," Grade 9, £639/9/- per annum.

SHIFT CHARGE ENGINEER—Grove Road Generating Station. Salary: Class "F," Grade 7, £656/5/- per annum.

All salaries shown are inclusive of London Allowance.

Applications, stating age, qualifications and experience should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, quoting reference SY/EST, and clearly stating post desired, within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.

(L 190)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the following appointments at salaries in accordance with the National Joint Board Agreement.

(a) GENERAL ASSISTANT ENGINEER (Metering) in the Technical Department at Divisional Headquarters, Cardiff. Class "AX/CX," Grade 8 (£437 to £604 per annum).

(b) COMBUSTION AND EFFICIENCY ENGINEER, East Power Station, Newport. Class "F," Grade 7 (£625 to £643 per annum).

(c) ASSISTANT COMBUSTION ENGINEER, Upper Boat Power Station, near Pontypridd. Class "H," Grade 9 (£609 to £633 per annum).

(d) STATION SHIFT CONTROL ENGINEER, Tir John Power Station, Swansea. Class "G," Grade 10 (£539 to £561 per annum).

Applicants for (a) should possess the Higher National Certificate in Electrical Engineering or an equivalent qualification, and have had experience in the maintenance and testing of Polyphase metering equipment. Experience in the Class "A" Polyphase testing station will be considered an advantage.

Salaries in respect of appointments (b) and (c) are provisional and subject to negotiation through the National Joint Board. Applicants for these appointments should preferably have obtained the Higher National Certificate or its equivalent, and previous experience in the operation and efficiency control of high pressure steam plant is essential.

Candidates for appointment (d) should preferably have served a regular apprenticeship, obtained the Higher National Certificate and must have had previous experience in the control room of a modern power station.

The appointments are superannuable in accordance with the British Electricity Authority and Area Boards' scheme.

Forms of application may be obtained from the Divisional Secretary at the address below, to whom completed forms should be returned not later than July 7, 1951.

H. V. PUGH,
Divisional Controller.

Cardiff (Pengam Moors) Airport,
Cardiff. (L 241)

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following posts:—

PLANNING ENGINEER
(Amended Notice)

Uxbridge District of No. 1 (Southall) Sub-Area. Salary N.J.B. E/7/1 (£579 per annum plus London weighting), N.J.B. conditions of service.

Candidates should have had experience in the preparation of proposals and estimates for extension of h.v. and l.v. networks and substations operated at voltages up to and including 11kV, and the ability to deal with the preparatory work prior to construction. They should have had a good technical training. Corporate membership of the I.E.E. would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary and returned to him at 2/6 Windmill Lane, Southall, Middlesex, not later than seven days after the appearance of this notice.

AGRICULTURAL REPRESENTATIVE

Chichester/Portsmouth District of No. 3 (Portsmouth) Sub-Area. Salary N.J.C. Grade 3 (£450 per annum), N.J.C. conditio s of service.

Candidates should have a sound knowledge of the applications of electricity in agriculture and horticulture, be capable of preparing estimates for small wiring installations and equipment; conducting negotiations and obtaining new business. Ability to give talks to agricultural organisations will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary and returned to him at Lower Drayton Lane, Cosham, Portsmouth, not later than ten days after the appearance of this notice.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' superannuation scheme, if eligible.

F. W. KEMPTON,
Secretary.

(L 260)

EASTERN ELECTRICITY BOARD

Northmet Sub-Area

DRAUGHTSMEN

APPLICATIONS are invited to fill several vacancies upon the staff of the Sub-Area Engineer from candidates having the requisite training and experience for one of the following branches:—

(a) Substations. Layout of Switchgear, transformers and associated equipment for outdoor and indoor type substations up to 33 kV.

(b) Mains. Overhead line design and layout of associated equipment, underground cable trench sections, survey and route plans, and general mains recording maps and plans.

(c) Architectural. Plans and detailed drawings of building and civil engineering works, including reinforced concrete construction for substations, service centres, workshops and offices.

The salaries offered and conditions of service are subject to negotiation by the appropriate negotiating bodies, but the salaries will not be less than those shown below:—

(i) Senior Draughtsmen, £525 to £630 per annum.
(ii) Engineering Draughtsmen (or equivalent in Building), £420 to £525 per annum.
(iii) Drawing Office Assistants (or draughtsmen in training), £258 to £415 per annum.

These salaries include an allowance for London Weighting.

Successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, stating age, education, technical qualifications and experience, with details of present appointment and salary, should be submitted to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London N.14. (L 127)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the post of ASSISTANT CHEMIST at Longford Generating Station, Coventry.

Applicants should have had practical experience in the analysis of coal, water, oil, etc., for power station requirements. Preference will be given to candidates possessing the Higher National Certificate in Chemistry or equivalent qualifications.

The salary for this appointment will be in accordance with Class "G", Grade 9, £571 to £597 per annum of the N.J.B. Scale, and the post will be superannuable within the provisions of the British Electricity Authority and Area Board's Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and be returned not later than July 13, 1951.

L. F. JEFFREY,
Divisional Controller.

(L 275)

NORTH WESTERN ELECTRICITY BOARD

Area Board Headquarters

APPLICATIONS are invited for the following appointments in the Planning and Development Section of the Chief Engineer's Department at Area Board Headquarters, Cheetwood Road, Manchester 8.

(1) THIRD ASSISTANT ENGINEER

Applicants should have had a sound fundamental training in electrical engineering and general experience in electricity distribution. Preference will be given to applicants possessing a University Degree or Higher National Certificate in Electrical Engineering.

The duties will include the calculation of system fault levels and load flows on complicated networks, and a good knowledge of mathematics is essential.

The salary for the post will be in accordance with the National Joint Board Revised Agreement and will be within the range of Class "AX/DX," Grade 5, i.e., £579 to £776 per annum, according to qualifications and experience.

(2) JUNIOR ENGINEER

Applicants should have had a sound fundamental training in electrical engineering, and preference will be given to those possessing a University Degree or Higher National Certificate in Electrical Engineering.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, and will be within the range of Class "AX/DX", Grade 9, i.e., £375 to £552 per annum.

Applications, stating age, education, training and qualifications, present post and salary, and post for which application is made, should be received by the Establishment Officer, the North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, July 7, 1951.

No. 1 Sub-Area

JUNIOR ENGINEERS (Testing Assistants)

Applicants should have had experience of testing work associated with meters, instruments or protective equipment, and should be in possession of at least the Ordinary National Certificate and preferably the Higher National Certificate.

Experience in manufacturers' works will be considered an additional recommendation.

The salary will be in accordance with the National Joint Board Revised Schedule within the range of Class "M," Grades 21-17, i.e., £375 to £481 per annum.

JUNIOR ENGINEER (Installation Specifications)

Applications are invited for the appointment of Junior Engineer (Installation Specifications) in the Sub-Area Consumers' Engineer's Department, No. 1 Sub-Area.

Applicants should preferably have had experience in contracting work, particularly in large commercial premises, and in preparing specifications.

Possession of the National Certificate in Electrical Engineering, whilst not essential, will be considered an advantage.

The salary for the post will be in accordance with the National Joint Board Revised Schedule, Class "M," Grade 19/17, i.e., £415 to £481 per annum.

Applications for the above posts, stating age, qualifications, present post and salary, should be received by the Sub-Area Secretary, No. 1 Sub-Area, the North Western Electricity Board, Town Hall, Manchester 2, P.O. Box No. 493, not later than Saturday, July 7, 1951.

No. 3 Sub-Area

DISTRICT ENGINEER

Applications are invited for the appointment of District Engineer in the Rochdale District of the No. 3 (Oldham) Sub-Area.

Applicants should have had a sound training in electrical engineering, together with considerable experience in the operation and maintenance of substations, underground and overhead high and low voltage networks up to and including 33 kV, the supervision of constructional work and the keeping of essential mains and substation records. The successful applicant will be responsible for the general maintenance of supply in the district.

Preference will be given to applicants who are Corporate Members of the Institute of Electrical Engineers.

The salary will be in accordance with the National Joint Board Revised Agreement, Class "F," Grade 2, i.e., £916 to £937 to £958 per annum. The post is superannuable.

Applications, stating age, education, qualifications and experience, present post and salary, should be received by E. Binns, Esq., M.I.Mech.E., A.M.I.E.E., Sub-Area Manager, No. 3 Sub-Area, the North Western Electricity Board, Union Street, Oldham, not later than Saturday July 7, 1951.

No. 6 (Lakeland) Sub-Area

APPOINTMENT OF DEMONSTRATORS

Applications are invited for the appointment of Demonstrators in the Whitehaven and Penrith Districts of the No. 6 (Lakeland) Sub-Area.

Applicants should be experienced in public demonstrations of electric cookers and other electrical ap-

(*Continued in next column*)

(*Continued from previous column*)

pliances, and hold a recognised certificate in Domestic Science.

Should the successful candidates not already hold the E.A.W. Certificate, they will be expected to take suitable courses to obtain the Certificate and eventually the Diploma.

The salaries for the posts will be in accordance with Grade 1 of the National Joint Council (Administrative and Clerical Grades) for the Electricity Supply Industry Salary Grades, i.e., £310 by £20 to £390 per annum. (Progress beyond £350 will be subject to a certificate that the person concerned is capable of undertaking all the duties of the grade.)

Applications, stating age, education, training, experience, present post and salary, should be received by the Sub-Area Manager, No. 6 (Lakeland) Sub-Area, the North Western Electricity Board, Castle Green, Kendal, not later than Saturday, July 7, 1951. (L 250)

EAST MIDLANDS ELECTRICITY BOARD

Lincolnshire Sub-Area

APPLICATIONS are invited for the post of FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER in the Grantham District of the Lincolnshire Sub-Area.

Candidates should preferably hold the Higher National Certificate in Electrical Engineering or similar qualifications and must have received a sound engineering training and be thoroughly experienced in the application and use of electricity for industrial, commercial and domestic purposes.

The successful candidate will be required to live in or near to Grantham and will be responsible to the District Senior Commercial Assistant for the supervision of the contracting section of the department and be capable of preparing specifications and estimates for all classes of installations. He should also be able to advise consumers on the purchase and utilisation of all types of electrical equipment.

The salary will be in accordance with Class "D," Grade 7, of the National Joint Board Agreement, commencing at £563 per annum.

Applications, stating age, qualifications, experience and present position, should be addressed to The District Manager, 21 High Street, Grantham, so as to arrive not later than Monday, July 9, 1951.

P. H. DE KEYSER,
Secretary. (L 276)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Transmission Department at Divisional Headquarters:—

THIRD ASSISTANT ENGINEERS (Maintenance Section).

Salary in accordance with the National Joint Board Agreement, Schedule C, Grade 5, Class "AX/CX" (£579-£753 per annum plus London Weighting). The commencing salary will depend upon qualifications and experience.

Applicants should have served an apprenticeship and should possess the Higher National Certificate in Electrical Engineering or its equivalent. They should have had considerable experience in the maintenance and operation of high voltage switchgear, transformers, cables and overhead lines up to 132 kV.

Corporate membership or Graduate membership of the Institution of Electrical Engineers is desirable.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Forms of application may be obtained from the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than July 14, 1951. Envelopes should be endorsed "Third Assistant Engineers (Maintenance Section)".

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (L 262)

BRITISH ELECTRICITY AUTHORITY

APPLICATIONS are invited for the post of JUNIOR ASSISTANT in the Agricultural Electrification Section of the Commercial Department at the London Headquarters.

Candidates should be studying or be prepared to study for the Higher National Certificate. The successful applicant would be required to travel out of London for short periods in connection with experimental work and investigations generally and to make reports on such investigations.

Salary will be paid within Grade 1 of the National Joint Council's permanent salary agreement, i.e. £325 per annum to £420 per annum, inclusive of London Allowance.

Applications, giving full details of age, qualifications and previous experience should be addressed to D. Moffat, Director of Establishments, British Electricity House, Great Portland Street, London, W.1, to be received not later than July 6, 1951.

Please mark the top left-hand corner of the envelope AE/184. (L 270)

BORD NA MONA

A vacancy exists for an

ELECTRICAL ENGINEERING ASSISTANT

with some experience in industrial electrical installations. Candidates must possess technical qualifications up to University or A.M.I.E.E. Standard and salary scale will be £400 by £25 to £800 per annum. Applications, stating age, qualifications and experience should reach, not later than July 7, 1951, the

SECRETARY,
BORD NA MONA,
28-30 Upper Pembroke Street,
DUBLIN.

(L 259)

A WELL-KNOWN Company requires JUNIOR ENGINEERS for their steam turbine division in the Midlands. Applicants should have good drawing office experience and a background of practical engineering, preferably directly connected with steam turbines. Please write, stating age, experience and qualifications, quoting ref. HJD(1) to Box No. 7097, Electrical Times. (L 253)

A WELL-KNOWN West Midland engineering company, manufacturers of 2- and 4-stroke internal combustion engines are in need of a first-class DESIGNER ENGINEER for magneto design. Suitably qualified men with a sound technical knowledge in the manufacture and design of magnetos are invited to apply.—Write, in confidence, giving details of age, previous experience and salary required, to Box No. 7071, Electrical Times. Endorse envelope "Personnel Department." (L 206)

AMBITIOUS men with suitable experience are invited to apply for posts as SENIOR DESIGN ENGINEERS with the Steam Turbine division of a well-known company in the Midlands. Excellent salary and prospects of promotion are offered in a department which is expanding and working on advanced design and development in this field.—Please write, in confidence, giving full details of experience and qualifications, quoting ref. HJD, to Box 7089, Electrical Times. (L 242)

AN ENGINEER is required, age 28-30, for development work in process controls specialising on the application of electronics, the post is a new one and will call for the capacity to work independently. Essential qualifications are age 28-30 with degree or Higher National Certificate in Electrical Engineering. The successful applicant will be posted in East Anglia and would be required to do a certain amount of travelling. There is a superannuation scheme, entry to which is dependent upon a satisfactory probationary period. The salary offered is £680 per annum. —Write, giving details of qualifications and experience to Box No. 7055, Electrical Times. (L 164)

APPLICATIONS are invited for the position of CHIEF INSPECTOR by a large electrical engineering manufacturer in the North-west of England engaged on switchgear, transformer, domestic appliance, etc., production. Senior position, involving control of a large inspection force. Permanent and pensionable. Applicants should have previous inspection experience.—Please write, giving details of apprenticeship, technical qualifications and experience, to Box No. 7073, Electrical Times. (L 207)

ASSISTANT DESIGNER required in Capacitor Dept. Duties will include the design of L.T. and H.T. capacitors for industrial purposes, preparation of power-factor correction schemes, etc. Candidates should have sound electrical training and experience, and hold Higher National Certificate or other qualifications. Five-day week. Good conditions. Pension scheme. Sports facilities. Applications, stating age, training, experience and salary expected, should be addressed to Employment and Welfare Manager, Johnson & Phillips, Ltd., Charlton, S.E.7. (L 274)

ASCO Ltd., are prepared to appoint SALES AGENTS for commercial refrigeration equipment in selected territories.—Asco Ltd., Refrigeration Division, Broadheath, nr. Manchester. (K 737)

ASSISTANT ELECTRICAL ENGINEER, 25-40, for superintendence of operation and maintenance work with public utility Nigerian Plateau. Three years' engagement in two 18-month tours. Generous allowances, ample leave on full pay, free quarters. Superannuation fund maturing age 55. Salary, £60 per month or according experience. —Applications, Box No. 7057, Electrical Times. (L 165)

DEPUTY RESIDENT ENGINEER required for a large engineering project in Arabia. Applicants must have had good civil engineering training and be familiar with the handling of large contracts. Preference will be given to engineers who also have mechanical engineering experience and hold a professional qualification. Salary in accordance with experience, plus overseas allowance and married accommodation.—Applications in writing, giving details of age and experience, should be addressed to the Secretary, Ewbank and Partners Ltd., Engineering Consultants, 15 Grosvenor Place, London S.W.1. (L 211)

DESIGNER wanted for low tension A.C. and D.C. control gear. State qualifications, age, experience and salary required. Box No. 2166, Howats Advertising, 111 Union Street, Glasgow, C.1. (L 256)

DESIGN ENGINEER required by successful old-established company in the North of England, engaged particularly in the manufacture of heavy duty a.c. switchgear. He should have scientific and commercial qualifications as well as practical experience, originality and initiative. He would have unlimited opportunity for developing his ability at a good salary, rising without limit according to his performance. To the right man the future prospects are bright.—Box No. 6079, Electrical Times. (K 805)

DRAUGHTSMEN AND ENGINEER DESIGNERS required for traction control gear. Men having good mechanical experience would be considered. Good remuneration for men of first-class experience.—Apply, quoting "Switchgear," to Staff Manager, The General Electric Co. Ltd., Witton, Birmingham 6. (L 174)

ELECTRICAL AND MECHANICAL ENGINEERS and metallurgists are required for experimental work at the Research Laboratories of The General Electric Co., Ltd., East Lane, North Wembley, Middlesex. Graduate staff are needed for work on radio-communications, domestic heating appliances, illumination, light mechanical engineering problems and in the metallurgical field.—Applications, giving age and record, should be sent to the Staff Manager (Ref. GBLC/429). (L 244)

ELECTRICAL DRAUGHTSMEN required for the electrical section of the drawing office of a large steelworks in North-West England. Applicants must have had experience in the layout of heavy power distribution system and have a background of practical experience in electrical engineering.—Applications, giving full details of experience and qualifications, and stating age and salary required, should be submitted to Box No. 7029, Electrical Times. (L 83)

ELECTRICAL DRAUGHTSMEN wanted for long-term oil refinery and chemical plant programme. Five-day week, pension and insurance plan.—Write, stating experience and salary required, to Chief Engineer, E. B. Badger and Sons (G.B.) Ltd., 40 Parkgate Road, Battersea, London S.W.11. (L 62)

ELECTRICAL ENGINEER for new factory in Glasgow wanted, to be responsible for installation and maintenance of all electrical plant and for future development work. Light industry, first-class working conditions, five-day week, liberal leave, all modern facilities, and a pension fund. Salary not less than £900 per annum at age 30. Candidates must have a university degree or equivalent, have served a student apprenticeship, and had experience of modern industrial electrification. Age limit 40. The prospects of promotion for an outstanding man are excellent; working conditions offer scope for individual initiative and enterprise, and a congenial atmosphere.—Box No. 7051, Electrical Times. (L 140)

ELECTRICAL ENGINEER with 3-5 years post graduate experience is required for the design of special types of small motors and generators to form part of a complete electro-mechanised system. Applications, in writing, to be sent to the Staff Manager (Ref. GBLC/441), Research Laboratories of The General Electric Co., Ltd., East Lane, North Wembley, Middlesex, stating qualifications, age and experience. (L 258)

ELECTRICAL FOREMAN—The Steel Company of Wales Ltd. still has a number of vacancies for Electrical Foreman (Maintenance) at its Abbey, Margam and Port Talbot Works. Apprenticeship and experience on maintenance of heavy industrial plant (preferably steelworks) are essential.—Applications, giving full particulars of training and experience, should be addressed to The Personnel Superintendent, The Steel Company of Wales Ltd., P.O. Box No. 3, Port Talbot. (L 214)

JOHNSON & PHILLIPS LTD.

Have vacancies for Draughtsmen as under:

SWITCHGEAR DEPARTMENT

TWO SENIOR DRAUGHTSMEN suitably qualified and competent to handle switchgear for indoor and outdoor main stations and substations up to 33,000 volts or to design switchgear apparatus embracing air break and oil break circuit breakers.
Both positions offer good scope to the right men with prospects of early promotion.

DRAUGHTSMEN FOR SOUTH AFRICA

Applicants must have good practical and technical experience, particularly in diagram and schematic work. Single men preferred, age range 22 to 25. Good opening for men of the right calibre.

TRANSFORMER DEPARTMENT

Draughtsmen capable of handling all medium size transformers up to 2,000 K.V.A.

DRAUGHTSMEN capable of handling sizes up to 5,000 K.V.A.
DRAUGHTSMEN having experience of larger transformers, 30 to 45 M.V.A.
These openings offer good prospects. Five-day week. Staff pension and bonus schemes. Welfare facilities include: A well organised athletic club with private sports ground, catering for cricket, football, tennis, etc. Works canteen equipped for billiards, table tennis, amateur dramatics, licensed bar.
Applications, giving full particulars of age, training, experience and salary required to:

Employment and Welfare Manager,
Johnson & Phillips Ltd., Charlton, London S.E.7
(L 82p)

ELECTRICAL ENGINEER, 25-35, married or single, required for public utility Georgetown, British Guiana, to supervise distribution, metering, 16,000 consumers and electric plant aggregating 12,500 kW. Three years' engagement. Salary 400 British Guiana dollars per month. —Further particulars from and applications to Box No. 7059, Electrical Times. (L 166)

FERRANTI LIMITED invite applications for senior appointments of Graduate Engineers with industrial experience in electrical measurements, particularly in electrical integrating energy metering both industrial and commercial, together with knowledge of testing equipment and facilities. The posts to be filled carry senior responsibility with excellent prospects, generous salary and pension.—Application forms from Mr. R. J. Hebbert, Staff Manager, Ferranti Limited, Hollinwood, Lancs. Please quote reference M.E. (K 744)

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JOINTERS MATES required immediately. Must be willing to travel. London rate of pay and out allowance.—Write, stating age and experience, to Box No. 7087, Electrical Times. (L 223)

JUNIOR DRAUGHTSMEN required, aged 21 to 25 years, preferably some experience overhead line switchgear. —Line Equipment, Ltd., Bridgend, Glam. (L 245)

JUNIOR ELECTRICAL ENGINEER required by consulting engineers in Victoria district. Must have had some experience in the preparation of power and lighting installation schemes for hospitals, schools, factories, etc. Excellent prospects for suitable applicant—Apply to Box No. 7067, Electrical Times, stating age, experience, qualifications and salary required. (L 204)

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LONG-ESTABLISHED British Importing House in Indonesia requires services of (1) a qualified and experienced commercial BOOK-KEEPER; (2) an energetic and experienced SALESMAN with engineering training and adequate knowledge of Diesel and electric motors. Applicants must be single men, aged between 30 and 40 and in possession of Higher Leaving Certificate. Good salary, prospects with possibility of promotion.—Apply (in duplicate), stating age, education, qualifications and salary required, supported by references, to Box No. 7075, Electrical Times. (L 217)

LEVER BROTHERS AND UNILEVER LTD. invite applications for the post of POWER ENGINEER of a large food factory in the North West of England. The electrical plant includes 6.6 kV motors and switchgear, 6.6/0.4 kV transformers, M.V. distribution, M.V. power and lighting installations, electronic process control equipment, etc. for the maintenance, reorganisation and future extension of which the power engineer will be primarily responsible. The post also carries responsibility for the maintenance of other factory services (steam, water, refrigeration, compressed air, etc.) requiring some general mechanical engineering experience. An A.M.I.E.E. qualification and previous industrial experience in a similar capacity is essential. Age preferably between 35 and 40 years. Superannuation scheme. Salary according to experience.—All applications will be treated in the strictest confidence and should be addressed to Personnel Division (KAB-18), Lever Brothers and Unilever Ltd., Unilever House, Blackfriars, London E.C.4. (L 161)

METHODS ENGINEERS required to investigate shop problems and to initiate new methods and processes in connection with manufacture of high voltage switchgear. Applicants must have a wide practical experience and possess technical qualifications of H.N.C. standards or its equivalent. Very good prospects.—Write, stating full details of previous experience, etc., and salary required, quoting ref. IJC, to Box No. 7083, Electrical Times. (L 221)

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MERZ AND McLELLAN have a vacancy at their Esher Office for an ELECTRICAL ENGINEER capable of preparing specifications and analysing tenders and dealing with engineering problems associated with power station layouts and all electrical equipment associated therewith, including switchgear up to 33 kV. Applicants should be qualified engineers who have preferably obtained an engineering degree, completed at least two years' apprenticeship and had manufacturing experience. Salary will depend upon age and experience.—Applicants should apply to Merz and McLellan, Milburn, Esher, stating age, salary required, education, qualifications and details of training and experience. (L 224)

OVERHEAD LINE ENGINEERS required by Consulting Engineers for work in North Scotland. Experience in the construction of H.V. and L.V. distribution networks essential. Apply, in writing, to Kennedy and Donkin, 32 Alva Street, Edinburgh, 2. (L 257)

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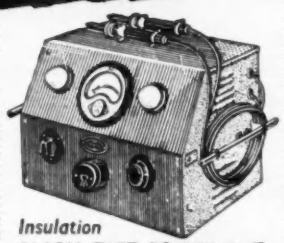

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65	1,500	Brook	S. Protected	Slip Ring
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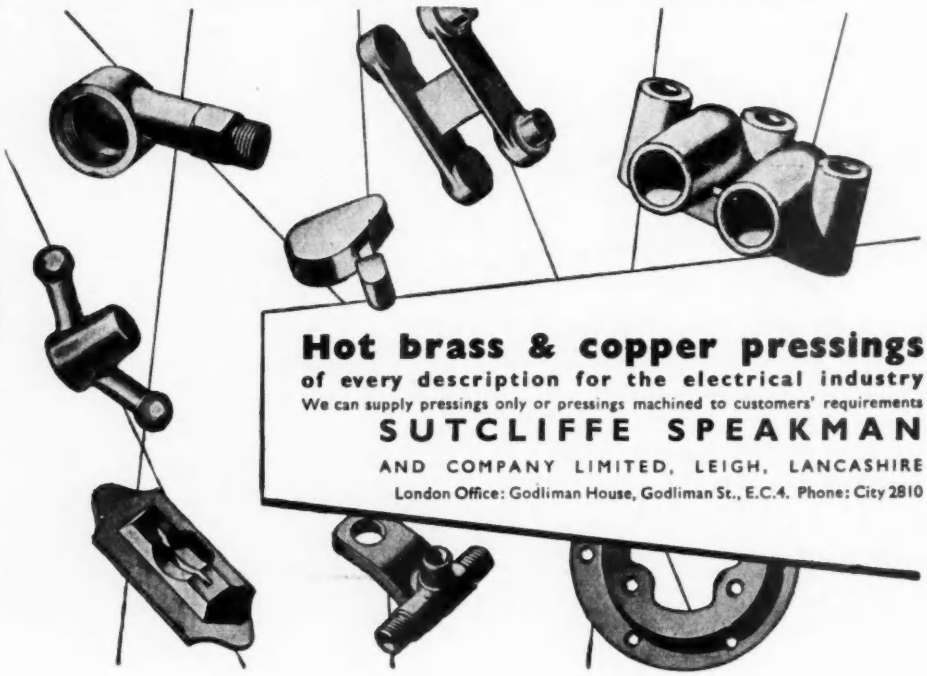

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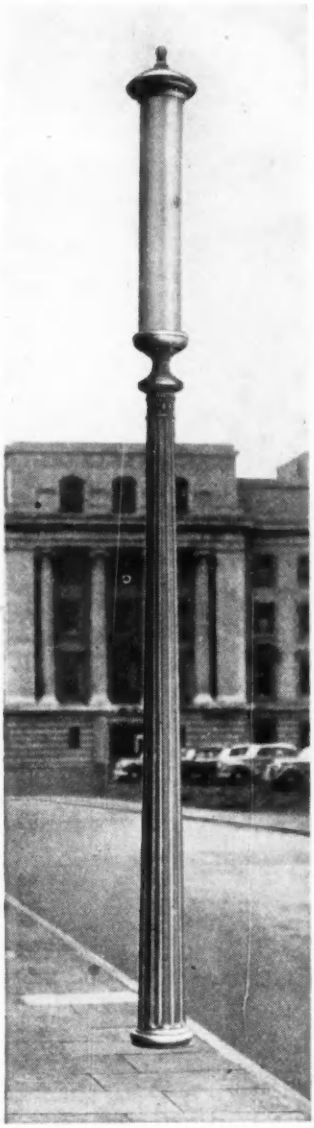

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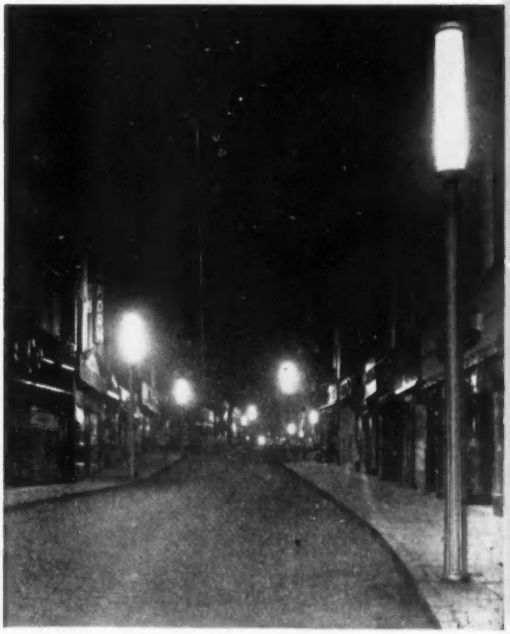

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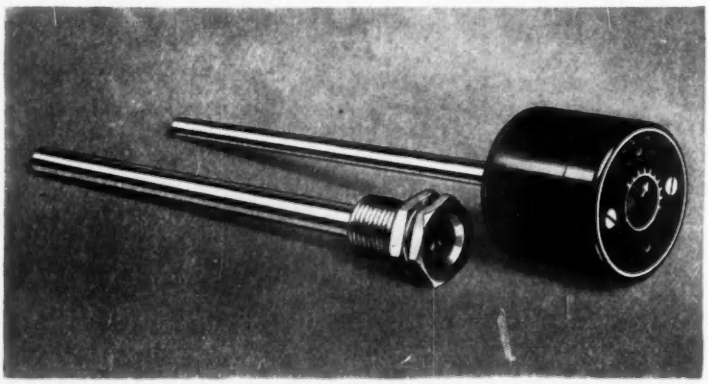

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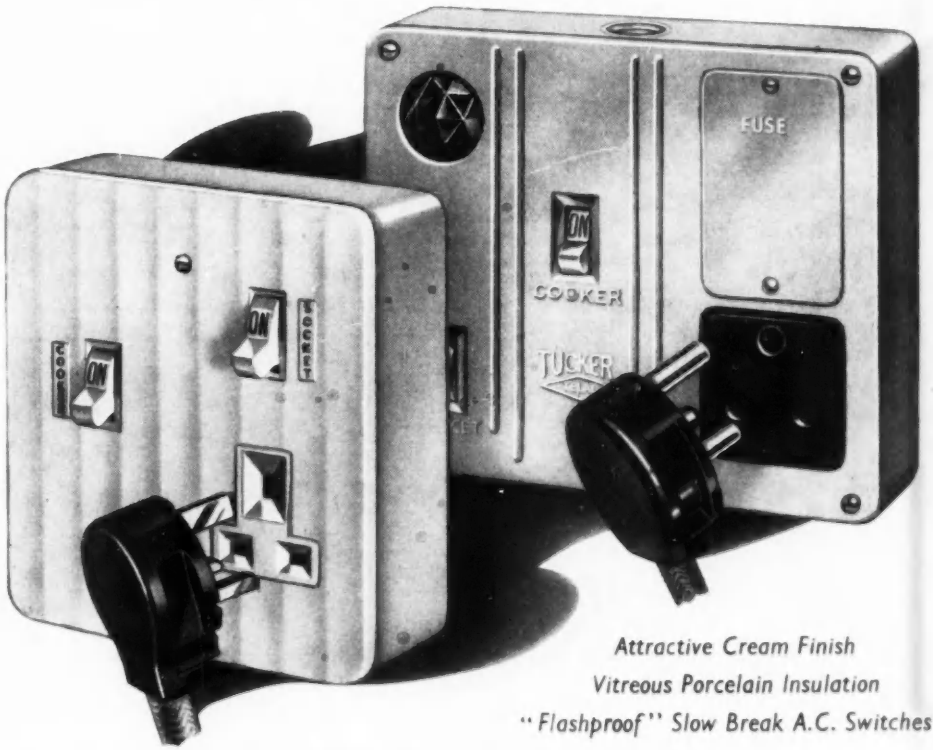

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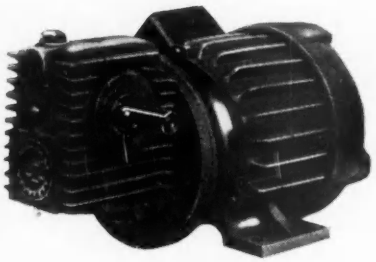

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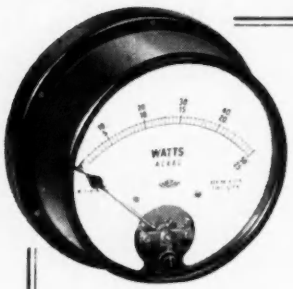

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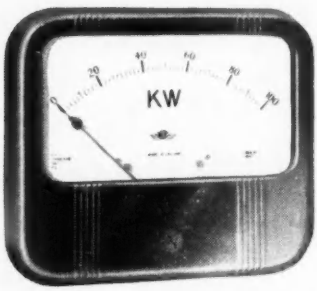

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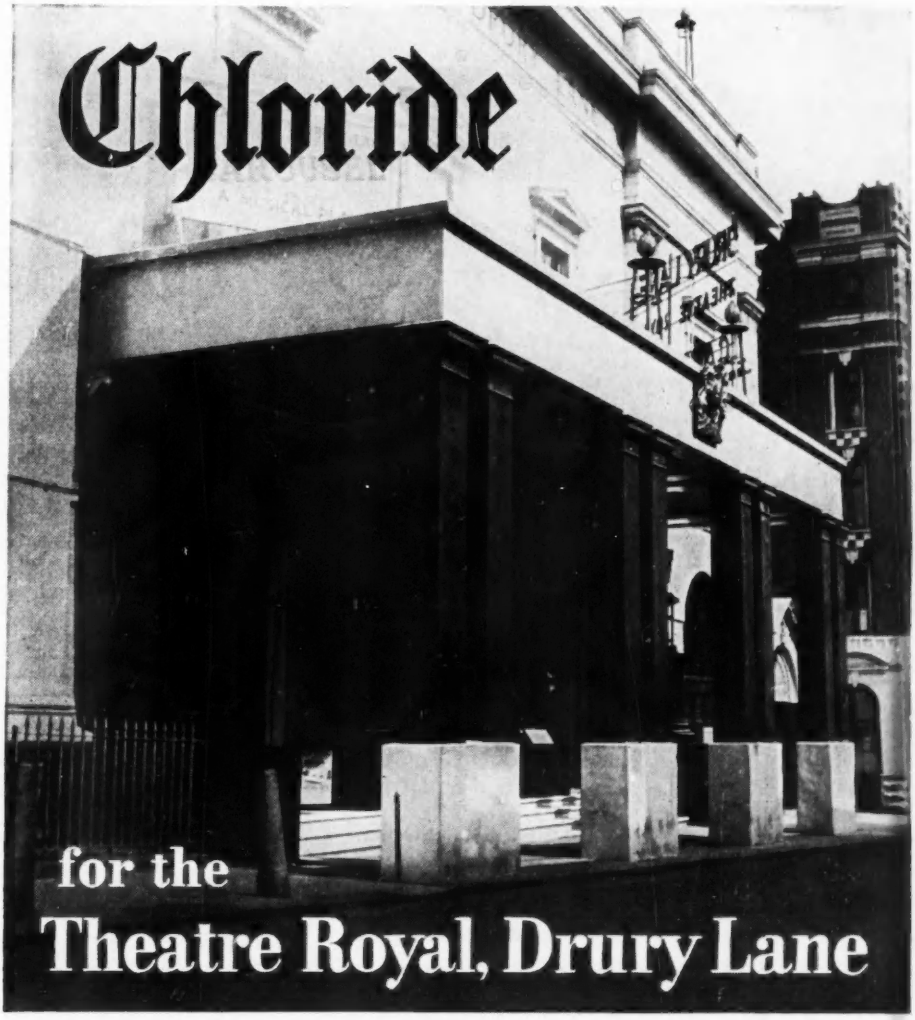

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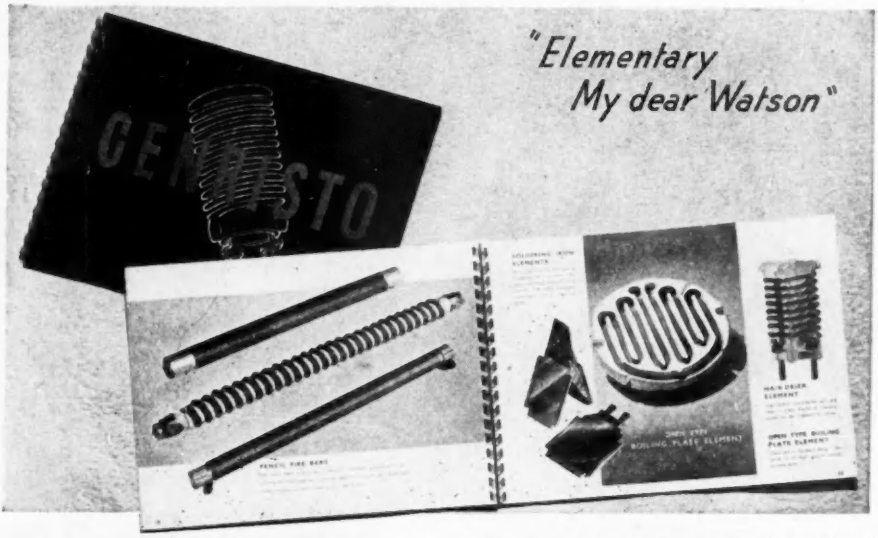

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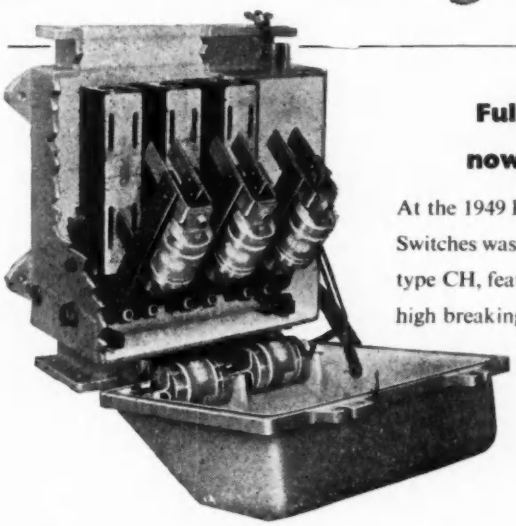

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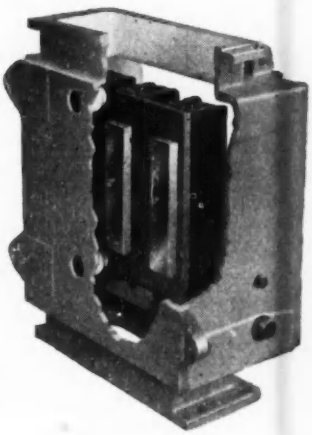

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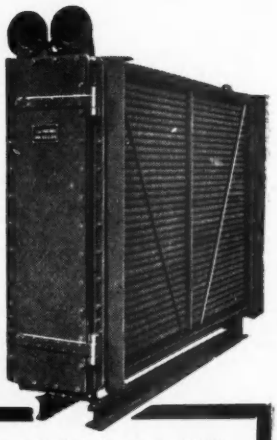

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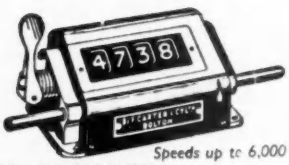

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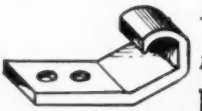

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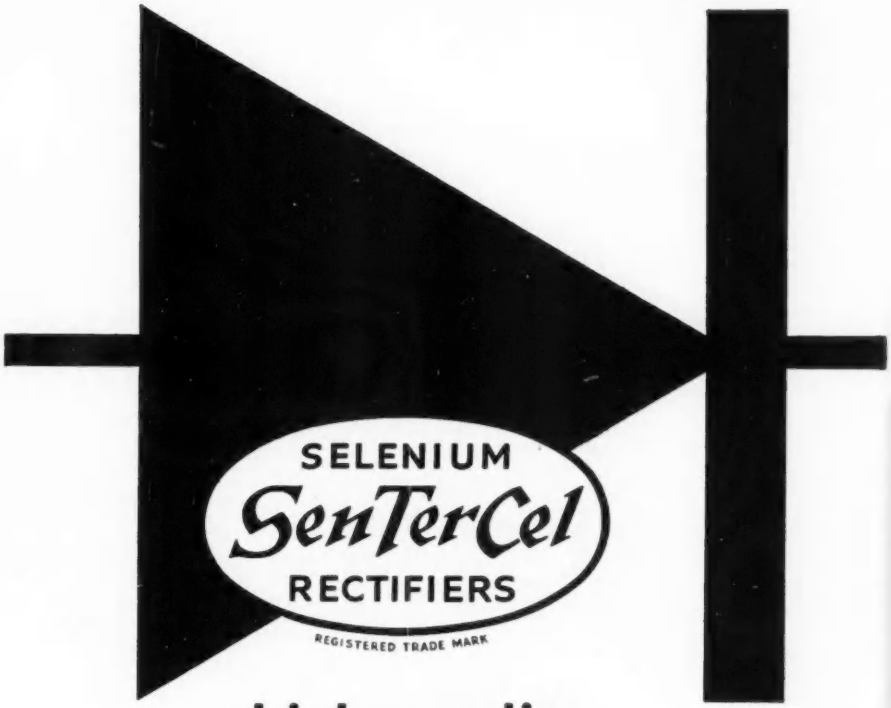

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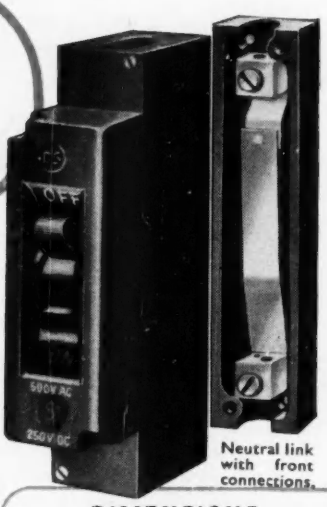

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Designed to give unfailing protection to all types of electrical circuits and equipment up to a maximum current rating of 50 amps at 500 V a.c. or 250 V d.c. On ordinary overloads tripping may be instantaneous or have an inverse time delay characteristic, but in all cases instantaneous tripping occurs on a large overload or short circuit. The mechanism is normally sealed to prevent interference with settings. Neutral mechanism designed as a separate unit, to be fitted underneath the main unit when required. Certified rupturing capacities 10,000 amp at 250 V d.c., 10,000 amp at 440 V a.c. at pf. 0.62 lag.

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